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Engineering News-Record

A Consolidation of Engineering News and Engineering Record
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In This Issue:

The Bush Building, a 30-Story New York Structure on a 50x90-Foot Lot (see opposite).

Suggestions for Paving Parkway Drives —By S. Whinery.

Tornado Effects on Structures— By S. H. Ingberg.

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Each Lug on each Kreolite Lug Wood Block does many things. Among these things are:

1. Absorbs all stresses of expansion and contraction.
2. Prevents the pavement from "buckling."
3. Prevents the Kreolite oil from being squeezed out of the block.
4. Provides a space between the blocks (shown clearly in the picture) which insures a foothold for horses and ideal traction for motor vehicles. Now then—read these Kreolite Lug advantages into YOUR paving problems.

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ENGINEERING NEWS-RECORD

A WEEKLY JOURNAL
DEVOTED TO CIVIL ENGINEERING
AND CONTRACTING

Volume 79 NEW YORK, THURSDAY, OCTOBER 18, 1917 Number 16

The Second Liberty Loan

THERE REMAINS but a week before subscriptions will close for the Second Liberty Loan of 1917. That means a week of opportunity—of opportunity to oversubscribe the issue vastly, of opportunity to readjust oneself mentally in order to make a personal subscription that will tax one's ability to meet. For that is the frame of mind to which everyone must come. We must expect the war to pinch us, to force us to hitherto unthought of economies and self denial. That attitude will come naturally if the war continues for a year or two, but if it could be attained quickly it would insure an earlier end of the conflict. We have not learned yet, as have England and France and Canada and Germany, to bend every energy to the war, the efforts of individuals as well as of the government and of industry. We are making progress, and these Liberty loans make us hasten our pace. No man can say truthfully that he has done his part unless his subscription is so large that the payments can be met only with difficulty and at the price of personal sacrifice.

Road Builders Are Responding to Call

IN AN effort to secure quickly volunteers for the new road-construction regiment, the 23rd Engineers, the commanding officer of that unit two weeks ago called upon this journal for help in securing the right type of men. To the appeal for highway-builders, published in our issue of Oct. 4, the results, as set forth on page 762 of this issue, have been highly gratifying. From all parts of the country the replies are pouring in. It must be remembered, however, that the plans for the new regiment, as previously announced, will make it the largest in the United States Army—practically the size of an ordinary brigade. In spite of the great volume of applications received to date, therefore, there is still room for more. Men with practical construction experience are the ones particularly sought. The campaign for men must continue with unabated effort until the ranks are filled. Engineers can be of immense help by rounding up recruits and by getting their local papers to pass the word along.

Army Camps Will Save Food and Other Wastes

WASTE utilization at national army and embarkation camps, under a plan worked out by Colonel Ellison for the War Department, bids fair to yield to the government a revenue of a million dollars a year, besides saving a million of capital outlay for destructors and other plant for final disposal of wastes, and a half million to a million annually of operating expenses. This is not all. The conservation of the various wastes will add materially to animal feed and to the fertilizer and grease resources of the country in a time of great need. This is no time to bury or burn the immense food wastes of either camps or cities.

Providing Against Tornado Losses

IN CERTAIN sections of the United States the danger to life and property from storms is greater than that from conflagrations, because not only is the expectation of occurrence greater, but the protection afforded is less. Against fire a city has the protection of safe construction and public fire-fighting facilities, to say nothing of the growing precautionary measures which tend to reduce occurrence of fires. Against extraordinary wind, only sturdy construction will prevail. Wind cannot be prevented and it cannot be fought. Probably because of this human helplessness in the presence of the great natural forces, destruction of structures by storm is still looked upon generally as an act of God against which precautions are futile. Building codes, which are fairly advanced in fire-protection details, rarely pay any attention to structural details to reduce loss by excessive wind in any but the highest class of steel frame. The framers of such codes would do well to read the analysis of three recent tornadoes in the middle west, as given by Mr. Ingberg on another page of this issue. This analysis shows that there are certain elementary rules of construction which will reduce wind losses materially, not only in the small buildings where such losses predominate, but also in some of the larger structures which fall within the provinces of the architect and the engineer.

Another Large City Adopts Commission Plan

ANOTHER VICTORY for better city government was recorded on Oct. 9, when the voters of Newark, N. J., by a large majority, indorsed the commission plan. Newark is the fourth city of more than 300,000 population to adopt commission government, the other three being Buffalo, New Orleans and Jersey City. Large and small, five hundred cities of the United States have discarded their overlapping and conflicting councils, boards and single-headed commissions and put all their municipal affairs in the hands of small commissions. By this means power is centralized, responsibility fixed and efficiency made more readily possible

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What We May Come To

BY THIS DATE the Road Stone Control Committee, having control over road-stone quarries and slag dumps and works in England and Wales, will have put in full force their regulations or memorandum of procedure promulgated under date of July 11, this year. So drastic are these regulations and so fully do they recognize national necessity that the individual consumer has been practically pushed to one side—the quarry owners being permitted to retain but 5% of their present output to meet the urgent (sic) requirements of their private customers. Furthermore, they can supply no materials to any one, no matter whom, unless authorized by the committee, and they must furnish weekly reports of all materials supplied, indicating the amount and nature of the materials sent even to government departments, and to local or other authorities. Contractors and others carrying out services for the various government departments must submit their requirements to the committee on special forms, and furthermore must give due regard to the economy of railroad facilities in selecting the quarries from which they are to buy their materials.

It seems almost impossible that a contingency such as this indicates should arise. Of all construction materials stone is the most universally distributed. But there are, no doubt, other objects in the creation of the Stone Control Committee than merely the prevention of waste of the stone itself. Man-power as well as explosives and mechanical plant are being used to such a high degree of completeness that to waste a ton of rock may be equivalent to many lives on the battle front.

It is hard for us here in America to realize the press of circumstances which may bring about a situation of this intensity, but we are only a few months in the war and perhaps before the passage of another year—unless peace comes in the meantime—we may find ourselves in a like situation. And perhaps, after all, the utilization of certain modern governmental extensions, misnamed "socialistic principles," may be carried into our peaceful years with no damage to our individual freedom but with an actual and worth-while increase in our individual well being.

Closed River Gives Water-Front Streets

CLOSE the Milwaukee River to navigation by lake steamers. This is the main recommendation of a report made recently by local engineers at Milwaukee, Wis. The action indorses the editorial statement made in *Engineering News-Record* of July 19 to the effect that harbors in small rivers are obsolete as ports for the modern traffic of the Great Lakes. The Milwaukee report is based on an investigation which was commenced more than a year ago, and its conclusions were little, if at all, influenced by the river accident noted in the former editorial. The river is narrow and winding, crossed by numerous old drawbridges which are a hindrance to the city's busy street traffic. Near the river mouth there are conditions favorable to the development of up-to-date harbor facilities. The fact that such a development—long overdue—is now under consideration, is a strong argument in favor of the proposal to close the river, which would still be available for barge traffic. One of the most interesting features of the report is the proposal to build a viaduct along each side of the river, within the waterway, in order to provide new thoroughfares and relieve congestion in the strets of the busy section of the city. Thus new traffic routes would be established without encroaching upon the flow capacity of the channel, and without taking valuable property which is needed for buildings and other purposes. The plans, as noted elsewhere, are only tentative. But the general scheme is an excellent example of what may be planned by far-seeing men.

The Riddle of the Roads

ALTHOUGH scientific road cost data are becoming more and more valuable each day, highway engineers, in many cases, are putting into their files information which is seriously lacking in a number of particulars. This result is due to the fact that many men do not understand what cost data are, what items should be charged to maintenance, what segregation should be made of the various operations. Neglect of these matters has produced more or less doubt and confusion when records are consulted. But better times are in sight. Through discussion of these features of keeping road cost data a considerable improvement has been made, so that there are becoming available daily a larger and more and more valuable amount of road maintenance costs from many widely separated sections of the country.

One of the chief objects of these cost data is to determine the all-important question of the relative economy of various types of pavement under given conditions. This is the riddle which public officials, as well as taxpayers, expect the engineer to answer. A few highway engineers have ventured to make such an answer; the majority, however, very wisely have refrained. But in so doing they have called forth the criticism that they are remiss in a most important duty to the public. The few answers that have been attempted have resulted only in condemning the judgment of the engineers who made them, as it is manifest that their conclusions are not based on practical facts, but are in the last analysis, merely a tabulated statement of their personal opinions. Criticism of highways engineers in general follows: "They should have the proper data at hand, and be able to make a logical answer to the question as to the relative economy of various types of pavement," says the layman. Such criticism, *Engineering News-Record* believes, is not only unwarranted but betrays a lack of appreciation of all the conditions which surround this very complex problem.

The error lies in not considering how few the number of years has been since self-propelled vehicles, carrying heavy loads and moving at greatly increased rates of speed, created a new condition. This change has necessitated the construction of roads of far greater strength and durability than was ever before necessary. There are to be seen upon our country roads types of construction almost unknown for such work fifteen years ago. New methods and new types have been devised, as is evidenced in the remarkable development and use of the concrete road.

The wisdom that appreciates the necessity in normal times for the construction of roads giving promise of great durability has been impressed to a gratifying ex-

tent not only upon the minds of public officials but also upon the public generally. And so the demand for an answer as to what is the economical type of road becomes more and more insistent.

To determine definitely the real economy of a particular type of pavement we must have the results of long-time service tests. The essential factor is *time*. Many more years of experience with modern types of construction under the new traffic conditions must be had before engineers can determine with any reasonable precision their true relative economy.

Far from being a criticism for lack of foresight of highway engineers that such determinations have not been generally made, the situation demonstrates rather that nearly all highway engineers appreciate that they lack the essential element for making such determinations—and that those venturesome individuals who dare now to proclaim from their inner consciousness the answer to such a question only display total ignorance of the problem.

Engineers and the Typhoid Honor Roll

THE ENGINEERS and other sanitarians who have fought typhoid fever so persistently and successfully for the past three decades have reason to be proud of the typhoid record for 1916. The fifth annual typhoid survey made by the *Journal* of the American Medical Association shows that of the 60 cities of the United States having populations in 1916 estimated as 100,000 or more, 16 had typhoid death rates of less than 5 per 100,000, 19 of 5 to 10, 17 of 10 to 20, and 8 of more than 20 per 100,000.

From figures for 26 states (including the District of Columbia and Hawaii) made available in *Public Health Reports* for Sept. 21, it appears that one state had a typhoid rate in 1916 of less than 5 per 100,000; 11 of 5 to 10 (really 7.5 to 5.1); 8 of 10 to 20; and 6 of 20 to 34.2.

Two decades ago a typhoid death rate of 20 or less per 100,000 was regarded as creditable. In 1916, 52 of the largest cities of the country and 20 of the 26 states reported typhoid rates less than 20. In 1897, these states and cities might perhaps have been entitled to a place on a typhoid honor roll. Times have changed since then. With so many low records as were shown in 1916, the honor roll limit should now stop at say 5 per 100,000 for the cities and 7.5 for the states. With such standards, the roll for 1916 contains 16 of the 60 cities and 12 of the 24 states (District of Columbia and Hawaii here omitted) under consideration.

That 1916 was not an exceptional year is shown by the *Journal* survey. Half the 60 cities showed rates higher in 1916 than in 1915, yet except for a few cities the 1916 figures show a steady decline when compared with averages for the two previous half-decades.

Unquestionably, typhoid is vanishing. This was also shown, from a somewhat different viewpoint, in a quarter-century editorial retrospect in *Engineering News* of Mar. 29. Further evidence supporting the same conclusion is afforded by figures given in George A. Johnson's recent New England Water-Works Association paper on "Slow Sand Filters." These show that for the whole urban population of the United States the typhoid death rate was 48 per 100,000 in 1890, 40 in 1900, 27 in 1910 and (estimated?) 13 in 1917.

Encouraging as is the typhoid decline, the 1917 rate of 13 per 100,000 for a population estimated at 51,000,000, and also the 44 large cities and 12 states that have not yet attained the respective honor rolls of 5 and 7.5 per 100,000, show that while typhoid is vanishing much remains to be done in many quarters before it is vanquished.

The complete disappearance of typhoid is not to be expected. That a year may pass with almost no typhoid in a city of considerable size is shown by the leading city on the 1916 honor roll, Cambridge, Mass., with a rate of 0.9 per 100,000. Paterson, N. J., with 1.4, Spokane, Wash., with 2.0 and six other cities, making 9 in all, with rates of 3.5 or less per 100,000 in 1916, show possibilities which should be a stimulus to better sanitation and improved health board work in other cities.

The states which still have high typhoid rates should be stimulated to more vigorous and efficient action by the Massachusetts rate of 4.3, the Washington rate of 5.1 and the records of the ten other states on the honor roll of rates below 7.5.

What is pushing typhoid to the vanishing point? Where very high endemic rates have been cut down, the greatest factor has doubtless been purer water, including the substitution of public water-supplies for polluted private wells and of relatively pure for polluted sources of public supply. The better sanitary protection of sources of supply has played its part. Of great importance has been the widespread adoption of water purification by storage, sedimentation, coagulation, filtration, and chlorination. The installation of sewerage systems has contributed largely to typhoid reduction by speed in the removal of possible typhoid infection from houses and premises, and by making possible the abolition of cesspools and privies as polluters of private wells still in use for water-supply and as harbors for the typhoid-carrying fly. Many other agencies have helped in the campaign against typhoid but important as they are they need not be noted here, since engineers have much less to do with them than with improvements in water-supply and sewerage.

Anyone familiar with the water-supplies of the country is impressed by the fact that many of the cities with very low typhoid rates are not treating their water-supplies, or at most are only chlorinating them. But, broadly speaking, all the cities with low typhoid rates have good water-supplies, whether the latter are so naturally or are made so by purification; and there are numerous instances of low typhoid rates for which water filtration deserves chief credit.

In his own domain there is still much the engineer can do to vanquish typhoid—if only the cities will give him a chance to provide pure water and to remove and properly dispose of sewage. Money and trained men to operate these works, particularly to operate water-treatment plants under skilled supervision, are essential. Given a free hand to build properly and to operate efficiently, and freedom from political influence, the engineer and his brother sanitarians would soon transfer many a city and state from the roll of typhoid dishonor to the typhoid honor roll.

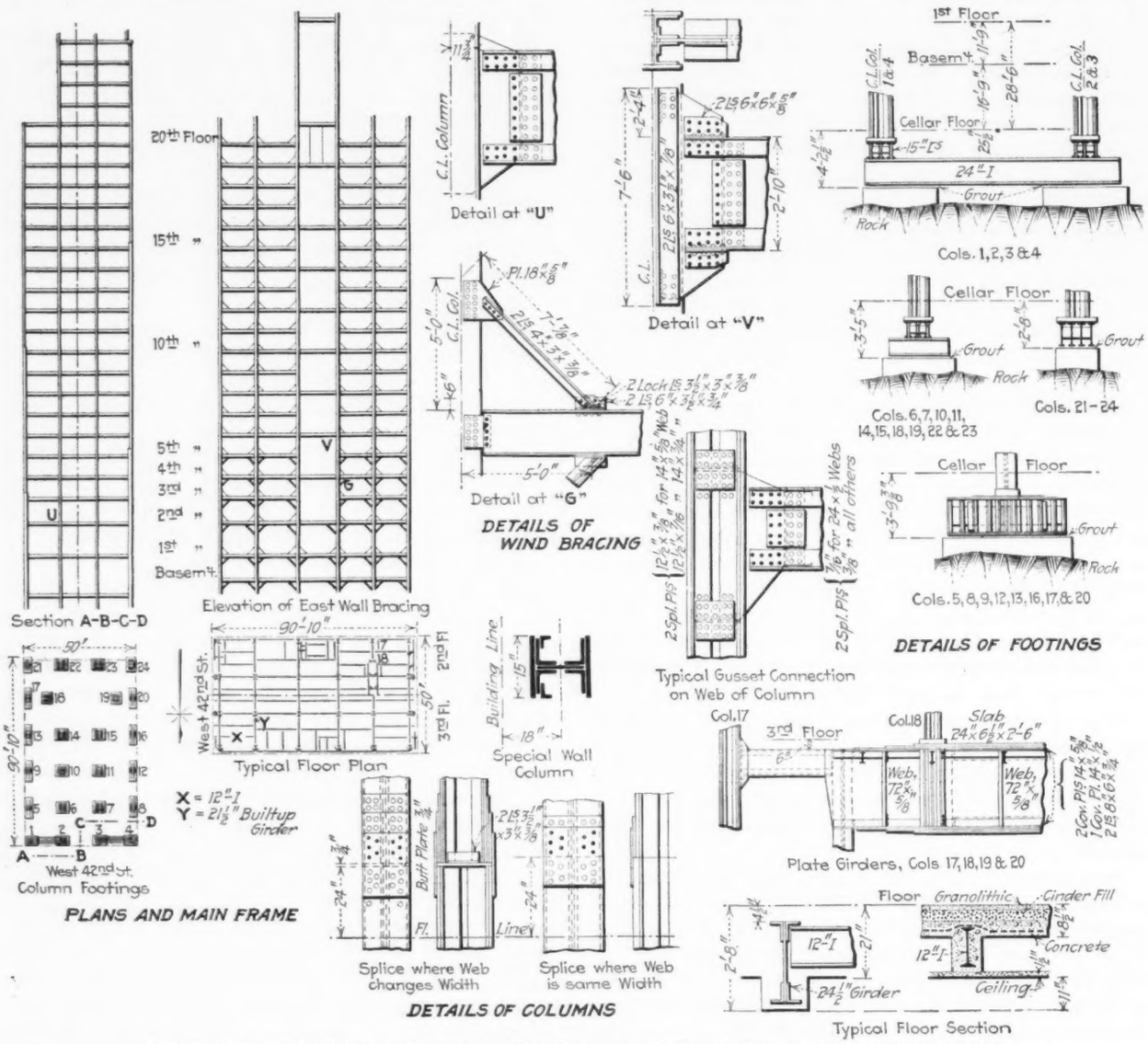
Tower Building Occupies Entire New York City Lot

Though Covering the Full Area of a 50 x 90 Foot Lot, New Bush Exhibition Building Has Been Made To Look Like a Tower by Special Brickwork on Party Walls To Simulate Offsets

ONE PROVISION of the new zoning law in New York City prohibits the erection of a very high building over the full area of the lot. As a result the tower, made familiar by the Singer, Woolworth and Metropolitan Life buildings, will probably become more common in the Metropolitan area, because such a construction permits the recessed elevation and the decreasing of plan area with height authorized by the law. Just before the law went into effect, however, one building was started in up-town New York, which while conforming to the old type of full-lot occupancy for the entire height, at the same time was so treated architecturally as to give it the appearance of one of the more modern forms of towers. This is the Bush Building, recently completed on the south side of 42d St. near the corner of Broadway. Not only is it the highest building in up-town New York, but it is of such striking and original appearance as to make it conspicuously attractive.

The Bush Building was built by Irving T. Bush, head of the Bush Terminal in South Brooklyn, originally as an exhibition building where the manufacturers from the terminal might exhibit their goods. It has grown to be a permanent exhibit building, and each of its 28 usable floors is given over to stores of sample merchandise of one sort or another for the attention of the visiting buyer. At one time it was planned to have hotel facilities in the house, but this has been abandoned, although meeting rooms are provided on the first floor.

The original lot on which the building stands was 50 ft. wide and 90 ft. deep. On this lot was erected the

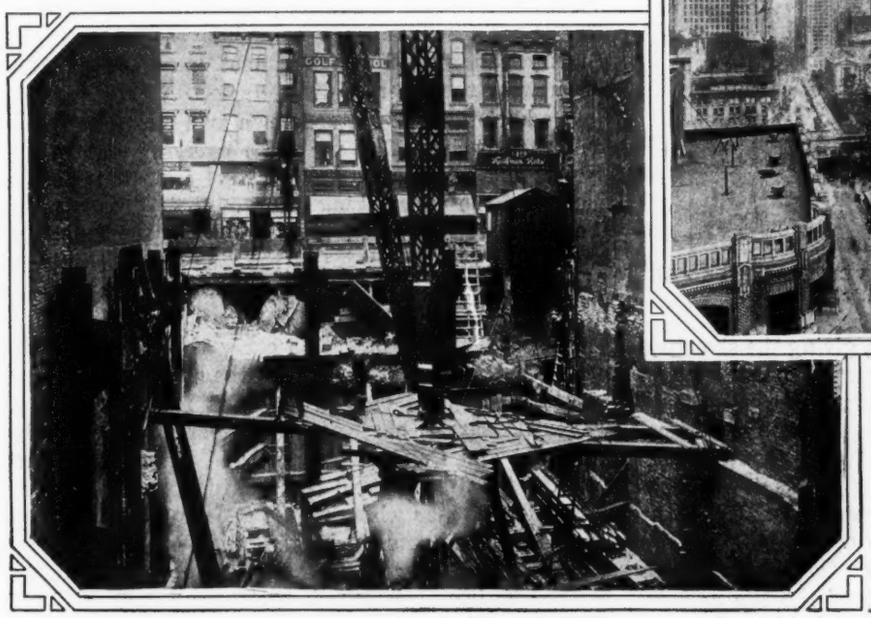


DETAILS OF STEELWORK OF THE THIRTY-STORY BUSH BUILDING IN NEW YORK CITY

steel frame of the building, 30 stories high. After this work was started the lot width through to 41st St. was acquired, and on this section there is now being built a nine-story reinforced-concrete building, the floors of which match and form one with those of the higher structure.

The new zoning law, which was by that time in force, limited the height of the 41st St. part. Brackets were placed on the rear columns of the steel frame, and the concrete girders of the rear portion were rested upon them. The concrete floor surface was then made continuous over the reinforced-concrete floor slab of the concrete building and the cinder-concrete slabs of the steel section.

BUSH BUILDING TOWERS FAR ABOVE NEIGHBORS OF GREAT WHITE WAY



FOUNDATION WORK IN BUSH BUILDING CARRIED OUT IN NARROW QUARTERS

The general details of the steel frame are shown in the accompanying drawings. They do not represent any great novelty, but furnish an example of high narrow framing. The plan is symmetrical, columns being placed on about 16-ft. centers in the narrow direction and in 18-ft. bays, with end bays of 16 ft. 3 in., over the long way. Girders are then framed across the building, with beams meeting the girders at the third points. This framing continues for 20 stories, when corner angle cut-offs reduce the plan somewhat to the 27th story, above which there is a further reduction in plan for architectural effect. The columns, however, continue through on their original lines.

One variation in the general plan occurs at the second floor, where two columns in the rear of the building are carried on a plate-girder across an auditorium area on the first floor. This girder, which is 29 ft. 10 in. between columns, is a box plate-girder section and is shown in detail on the drawing. The columns carrying it are offset from the regular position and are braced against the adjoining wall columns as shown.

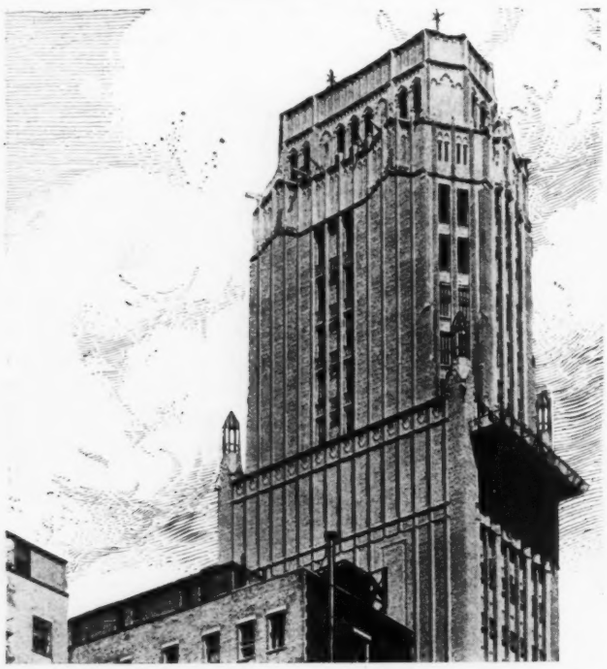
On the east side of the building the party wall is broken by an inset bay which gives light to the floors. The west wall is plain up to the 20th floor but has windows above that height, because the adjoining building under the law cannot come that high. The east wall bay is braced by a cross-beam every second story.

The wind-bracing details are shown in the drawing. They consist of upper and lower diagonal braces on the long side of the building up to the fifth floor, and upper diagonal braces up to the 20th floor. The narrow section of the frame is braced with heavy gussets as shown. No additional anchorage was necessary at the footings to take care of the overturning moment.

The floors are of cinder concrete reinforced as shown in the detail with a cinder fill and granolithic finish. The columns are of built-up H-section, generally made up of a web with outstanding angles, and plates where needed. The wall columns, however, have two additional angles turned inward from the outer legs of the building-line angles of the column section.

The footings are on rock, which was found some 30 or 40 ft. below street level. They comprise concrete pedestals carrying independent I-beam grillages in the middle of the building, built-up girder grillages along the adjoining walls and cantilever I-beams along the 42d St. front. Considerable difficulty was had with the footing work on account of the very narrow space in which to work and because, too, of wet ground which required constant pumping. One of the views shows the foundation after the footings had been placed, the adjoining walls underpinned and the columns placed.

As has been noted, the building has a most striking appearance. No little part of its novelty is due to the



CAMOUFLAGE IN BUILDING. THE VERTICAL RIBS ARE NOT OFFSETS BUT COLORED BRICK

apparent pilasters on the side walls, giving the structure the appearance of a tower architecturally complete on all four sides. These offsets are in fact nothing but colored brick, so arranged as to simulate the shadows of vertical ribs, which simulation is helped by two horizontal bands of tile corbels, which are triangularly indented to represent the juncture of two angular surfaces. Up to the 27th floor the east and west walls of the building are flat and on the lot line, except for the window inset mentioned and the 4-in. projection of the tile corbels. The building is finished in two-toned brick and terra-cotta, with a finial of decided ecclesiastic touch.

The architects for the Bush Building are Helmle & Corbett, of Brooklyn, the structural steel designers, Post & McCord of New York, and the general contractor, the Thompson-Starrett Co., of New York.

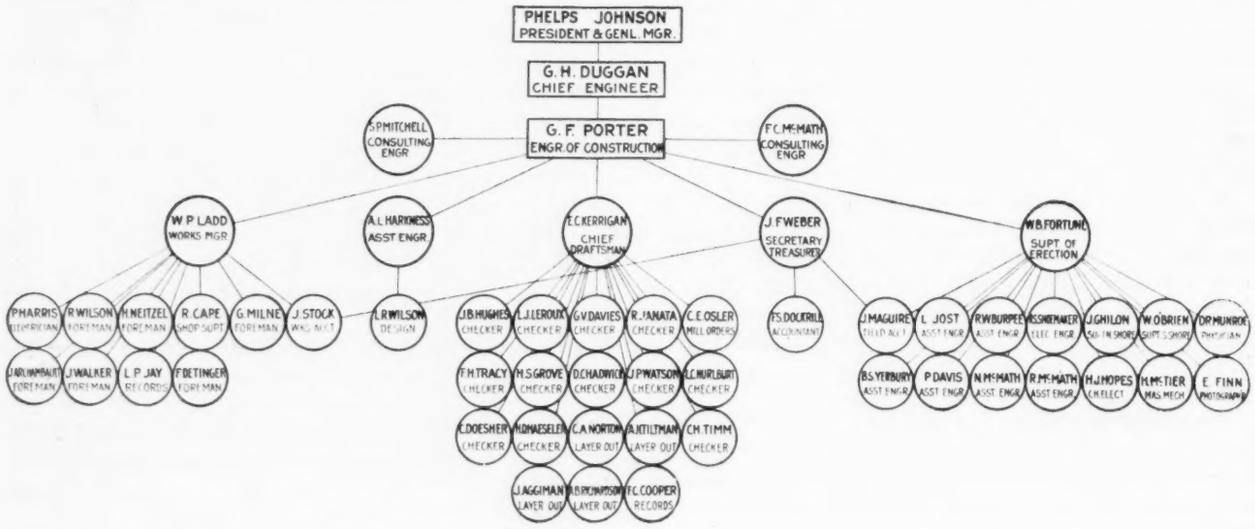
The Men Who Built the World's Greatest Bridge

Remarkable Organization Developed for Erecting Giant Structure at Quebec After Disaster of 1907

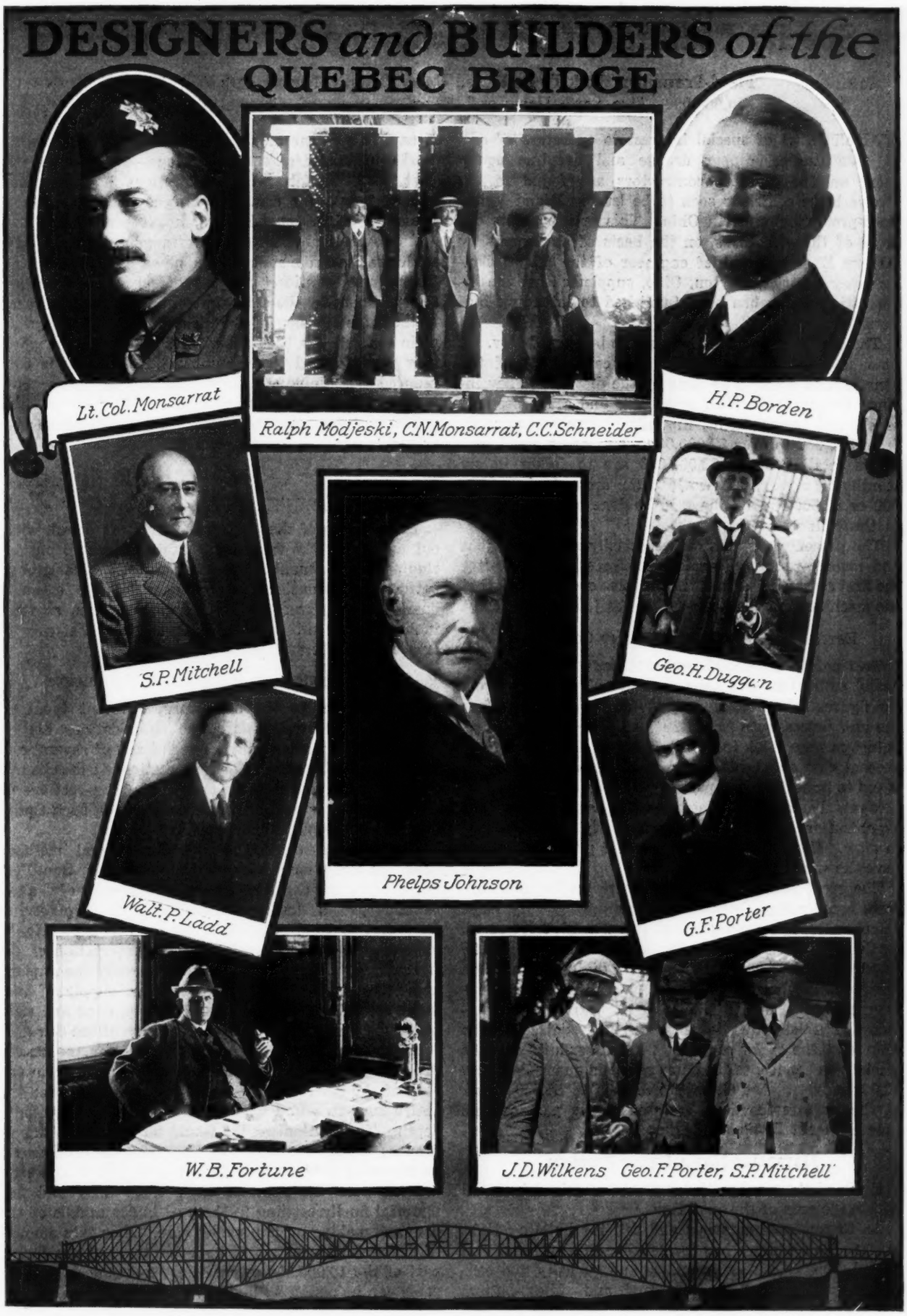
THE ENGINEERING world is familiar with the names, at least, of the men most closely connected with the second and successful attempt to construct the world's largest bridge, across the St. Lawrence River above Quebec. It is appropriate, however, as the work passes through its final stage following the raising of the suspended span, chronicled in *Engineering News-Record* of Sept. 27, p. 580, to publish their photographs for the benefit of the large part of the profession in this country and abroad which cannot have the privilege of knowing them personally.

In addition to the better known men most closely and continuously identified with the carrying out of the project as a whole, many others have contributed to the success of the undertaking years of their lives spent on the different sides and phases of the problem. The names and responsibilities of the men brought together in this work by the St. Lawrence Bridge Co. are shown in the diagram below. Of the organization formed by the Dominion government to carry through this great project after the failure of 1907, the names of the members of the Board of Engineers, at first composed of C. N. Monsarrat, chairman and chief engineer, Ralph Modjeski and C. C. Schneider, and after the latter's death of the first two and H. P. Borden, are well known.

Besides the men whose names appear on the chart below, the organization included Joseph Mayer, principal assistant engineer; A. J. Meyers, chief draftsman; M. B. Atkinson, assistant chief draftsman; H. W. McMillan, chief shop inspector; C. J. Yarnall, chief mill inspector; J. D. Wilkens, resident engineer, 1909 to 1915; John Rankin, resident engineer since 1915; W. P. Copp, chief inspector of erection; H. E. Bates, assistant engineer in shop and field work, and E. H. Pacy, assistant engineer.



ORGANIZATION CHART OF QUEBEC BRIDGE ENGINEERING FORCE


DESIGNERS and BUILDERS of the
QUEBEC BRIDGE
Lt. Col. Monsarrat
Ralph Modjeski, C.N. Monsarrat, C.C. Schneider
H.P. Borden
S.P. Mitchell
Phelps Johnson
Geo. H. Duggan
Walt. P. Ladd
G.F. Porter
W.B. Fortune
J.D. Wilkens Geo. F. Porter, S.P. Mitchell

Special Features of the Miami Conservancy Contracts

Flood-Prevention Work To Be Placed Under Contract Next Month Will Cost $10,000,000—Five Earth Dams and Seven Sections of Channel Included

FEATURES of special interest to operators of suction dredge, dipper dredge and dragline equipment and to concrete contractors are found in the twelve large contracts soon to be let for Miami Valley flood-protection work in Ohio. This article points out some of these features, on the basis of statements by Arthur E. Morgan, chief engineer of the Miami Conservancy District, Dayton, Ohio, supplementing the information which has been furnished to intending bidders.

The contracts on which bids are to be opened Nov. 15, amount to about $10,000,000 and cover 80% of the construction work to be done by the district. They include five earth dams of great size and seven sections of channel improvement, in contract amounts ranging from $25,000 to over $2,000,000. Numerous small contracts totaling about $2,000,000 are to follow in six months or a year, and work to the amount of $2,000,000 or $2,500,000 will have to be done by the railways in the vicinity of the dams.

The present contracts are essentially machinery jobs and require relatively small labor forces, at least after the first season. Further, they involve enough work that the machines may be worn out on the jobs economically.

Estimates Revised to Present Cost Basis

Two points of special moment are: (1) The engineers' estimates have been revised only recently from the figures submitted a year ago at the court hearing; the unit prices were raised 20% to 40% or more, averaging perhaps 30% increase, to bring them well up to present cost standards. (2) The district is fully prepared to undertake any part or all of the work by force-account, should the bidding not prove satisfactory. The organization has been developed partly with this end in view. However, the district would prefer greatly to have the work done by contract.

The great bulk of the work is earth moving and concrete construction, both classes running to very large amounts. Single contracts contain up to 4,000,000 cu.yd. earth excavation and placing and more than 40,000 cu.yd. concrete. The channel work, divided into seven contracts, includes 20,000 cu.yd. monolithic concrete revetment and 12,000 to 15,000 cu.yd. flexible-slab revetment. Specially high quality will be required in the linings of the outlet conduits. These conduits and the discharge channels of the dams range in quantities from 20,000 cu.yd. at the Germantown dam to 56,000 cu.yd. at the Taylorsville dam, and the larger part of this concrete must be placed during 1918.

Materials Not a Great Problem

Much of the construction material required is found within the area of the operations.

As to concrete materials and soil for building tight dams: The district has located deposits of sand and gravel satisfactory as to quality and quantity and conveniently located, both in upland and valley bottom sites. This is one result of continuing the exploration work—including extensive borings—all through the past year, though prior explorations had furnished sufficient data for complete designs and estimates as presented at the court hearing in November, 1916.

As to steel and cement: Arrangements have been made that assure a sufficient supply of steel sheet piling. The required reinforcing bars are likely to receive priority treatment by the steel control authorities; however, in thorough revision of the plans during the past year, plain concrete has been substituted for reinforced wherever possible, and the amount of steel needed is thus reduced to a minimum. No serious difficulty in securing a supply of cement is apprehended.

The following figures illustrate the cost-estimate situation affecting the concrete work:

	Estimate of Summer, 1916	Revised Estimate
Cement, per bbl	$1.60	$2.30
Steel, per lb	.04	.08

The revision of the plans was largely in detail, without modifying the factors of safety anywhere but including slight changes of location to fit the ground better, etc. Considerable reduction of the estimate quantities was accomplished in this revision, so that, in spite of the unit-price increase, the total cost was increased only about 10 to 15 per cent.

Wide Choice of Excavating Equipment

With respect to the earthwork, different types of equipment are applicable. The specifications are so drawn as to make possible the use of any of several different types. Moreover, the cross-sections of the channel improvements, and to some extent the cross-sections of the dams, will be modified if necessary to fit such equipment as may be most available.

Hydraulic Suction Dredges—The general methods used for the construction of the Calaveras, San Fernando and other dams in California, by means of the hydraulic suction dredge, as described in *Engineering Record*, Vol. 74, No. 8, page 220, and Vol. 70, No. 2, page 46, are entirely feasible in the construction of the Conservancy District dams. In the valleys of the streams above the dams there is an abundant supply of material consisting of a mixture of gravel, sand and clay, particularly suitable for the construction of the dams.

At the Huffman dam, as an illustration, a suction dredge can be located about 500 ft. upstream from the base of the dam, where suitable material exists for the entire 3000-ft. width of the valley and to an indefinite depth. The suction dredge would be allowed to dig as deep as would be found feasible. The material would be deposited in the toes of the dam, the gravel and sand settling near the point of deposit, the clay and fine material finally settling in the pool in the middle of the dam and making an impervious core. A certain amount of dry embankment would be necessary, but the larger part of the 10,000,000 cu.yd. of embankment in the five dams can be placed by hydraulic suction dredges.

About 4,000,000 cu.yd. of material are to be removed from the river channel at Dayton and Hamilton. Here too the hydraulic suction dredge is adaptable.

Draglines and Dipper Dredges—The removal of perhaps 2,000,000 cu.yd. of material at Dayton and Hamilton by means of draglines is entirely feasible. Regardless of the other equipment used, the use of draglines will be necessary to a considerable extent, to move the earth along the margins of the channel to a point where it can be reached by other equipment. There is also good opportunity for use of draglines at some or all of the dam sites.

In the construction of some of the dams it may be desirable to excavate the material from the river channel above the dam by dipper dredge, load it to barges and deliver it to a suction dredge at the base of the dam, in order to avoid long discharge pipe lines. These dipper dredges could also be used in digging the cut-off trenches under the dams. The channel work can be adapted to a very considerable extent to the use of dipper dredges, supplemented by draglines for trimming up the margins of the channels. It would be feasible to use from six to a dozen dipper dredges on the job, ranging in capacity from $1\frac{1}{2}$ to 5 yd., though the work would be so planned that one or two types would handle it.

Ladder Dredges, Steam Shovels, and Cableway Excavators—Most of the channel excavation at Dayton and Hamilton, involving about 4,000,000 cu.yd., could be done by means of ladder dredges, and the cross-section of the channel can be modified to suit this equipment. In case material for the construction of the dams is transported to the dams in barges, ladder dredges could be used for the excavation of five or six million yards at the dam site.

At the Lockington and Taylorsville dams the conditions are especially favorable to steam shovel work, if this method can compete in cost with suction dredge work. In this case, the material would be obtained from the hillside, the bulk of it requiring little or no lift. At the dam the material would be either sluiced in from the sides or spread and rolled.

One contract of about a million yards of channel excavation is peculiarly suited to certain types of cableway or tower excavating machinery, and some of the other work could be adapted to this type of equipment.

Forty or fifty acres of timber land must be cleared and grubbed. A large amount of soil stripping is necessary, which will require suitable excavating equipment. In the construction of the Englewood dam, for instance, 75,000 cu.yd. of earth must be removed in stripping the top-soil, and 85,000 cu.yd. must be replaced in the operation of surface dressing and grassing.

Barges and Cars as Alternatives to Pipe Lines—A large part of the earth excavated in the river channels and a considerable part of that to be used for building the dams must be transported by means of barges or cars, unless handled through the discharge pipe lines of suction dredges. In some cases one of these methods will be more economical and in some cases another, but in any case the use of barges may be an important item in the completion of certain of the contracts.

All sections of the work permit of cheaply ponding the stream to a depth sufficient for floating barges. At Hamilton a sufficient depth is already available in all seasons.

Extensive Concrete-Block Making Required—The plans for channel improvement at Dayton and Hamilton call for about 400,000 reinforced-concrete blocks, 24 x 12 x 6 in. These should be made during a period of about 18 months, which means that an output of at least 1000 blocks per day will have to be reached.

Stream-Control Risk Reduced—The stream control problem, which in the plans and specifications of a

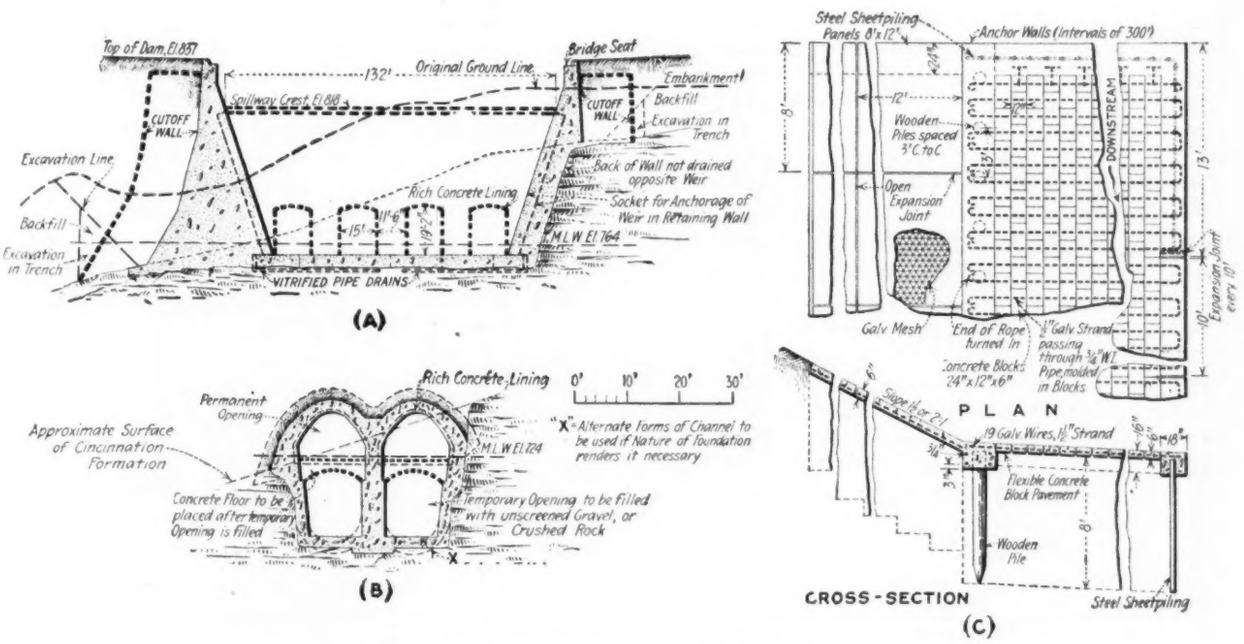


FIG. 1. CONCRETE SECTIONS IN THE MIAMI WORK RUN TO LARGE YARDAGES

A—Stream-control channel at Taylorsville Dam, about 50,000 cu.yd. to be placed during 1918. B—Double-deck conduit at Germantown Dam, the lower part filled after the dam is completed. C—Monolithic and flexible revetment slab at Dayton and Hamilton, totaling 35,000 cubic yards

year ago was left to the contractor, at his own risk of loss and damage, has been worked out in detail during the past season. It has proved possible to develop methods that greatly reduce the risk.

At three of the dams the method of stream control is as indicated in Fig. 2, and sketch *A* of Fig. 1, showing work at Taylorsville during the first two seasons. The spillway notch, all of concrete, is built first and the river later diverted through it while the dam is completed to a safe height. At the other two dams the method shown by Fig. 3 and sketch *B* of Fig. 1 for Germantown dam is to be used. Here the discharge conduits, temporarily built several times as large as the final size, are used for stream diversion. The lower part is subsequently filled and covered by a concrete deck to throttle the conduits to the dimensions desired in the final structure.

Other provision is made to assist the contractor in carrying on his work, such as furnishing camp sites, arranging for power and telephone service, assisting in finding subcontractors, etc.

Time of Completion—It is likely that unusual vigilance will be exercised in seeing that the contractors maintain satisfactory rates of progress. On the other

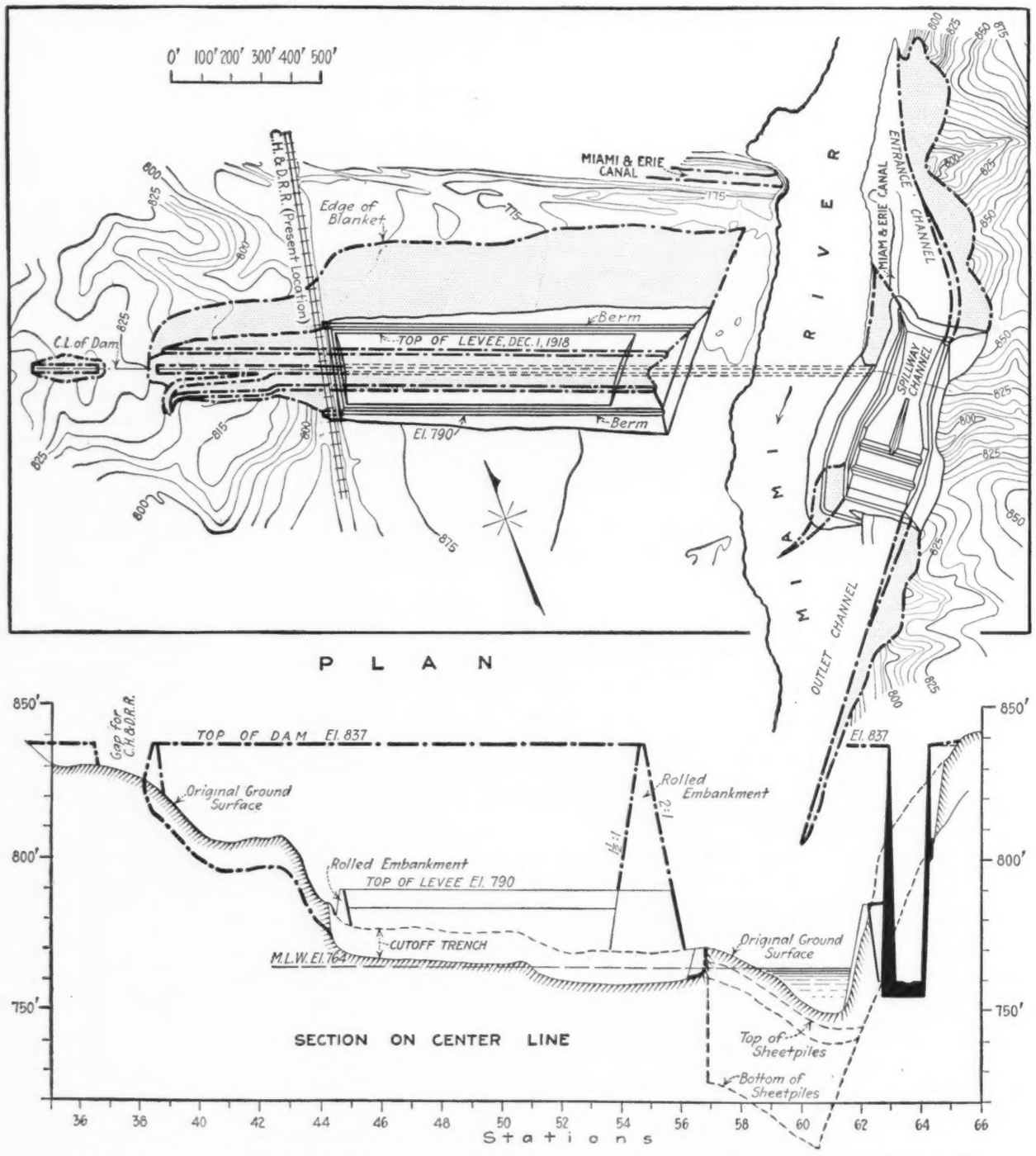


FIG. 2. RECOMMENDED STREAM-CONTROL METHOD AT TAYLORSVILLE DAM, GREAT MIAMI RIVER
Shaded part indicates second season's work, superimposed on that of first season

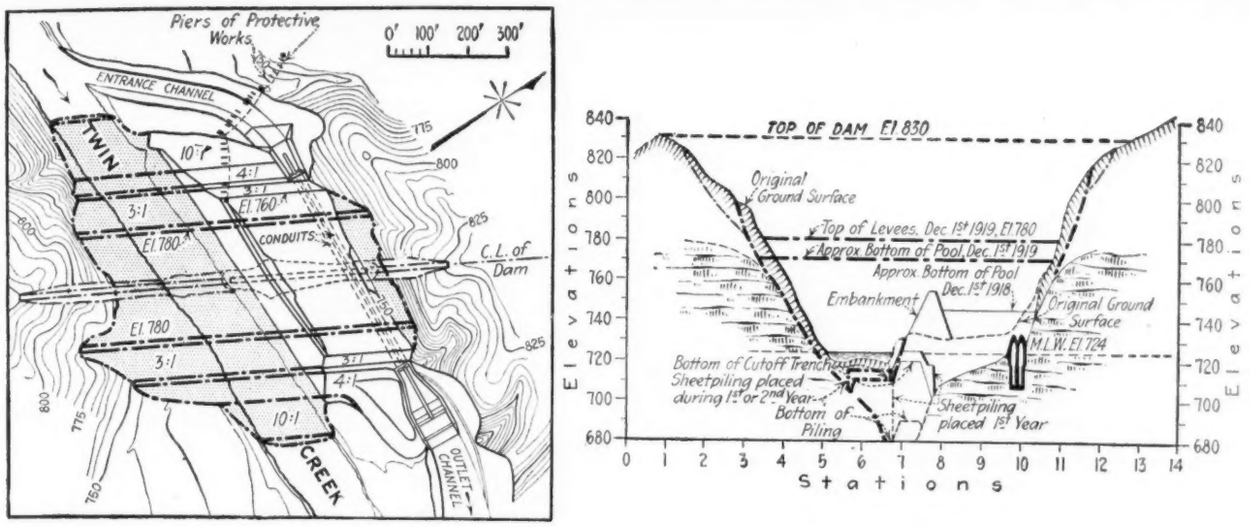


FIG. 3. STREAM CONTROL AT GERMANTOWN DAM, TWIN CREEK
Shaded part indicates second season's work, superimposed on that of first season

hand, the times of completion have been so fixed as to give about one season's leeway. In general, the stream control problem is expected to be disposed of by the end of 1919, but under certain circumstances the second season's work, carrying the project beyond all flood danger, may have to be executed during 1920. There is a similar margin of one season in final completion, making the whole work extend over either five or six seasons.

The enterprise has been financed. Assessment collections are coming in, and a bond issue for all needed funds has been assured. Work is to begin at once after contracts are let, and the end of the period of preparation has been fixed at Apr. 1, 1918.

The work will not necessarily be let to the lowest bidder, the Conservancy Act authorizing the court to sanction an award to other than the lowest, on the recommendation of the directors of the district.

Camp Wastes Yield Large Revenue to the Government

Colonel Ellison Describes Plan Under Which Garbage and Other Wastes at Nineteen Camps Have Been Sold

THE FEDERAL Government has established at the national army cantonments and embarkation camps a system of selling garbage, manure, tin cans, paper, bottles, etc., which will yield hundreds of thousands of dollars a year, besides saving heavy outlay for waste disposal plants and operating expense.

The comprehensive system of waste utilization being put into effect rapidly has been devised by Col. J. A. Ellison, First Delaware Infantry, who has for some time been in the Federal service, detached from his regiment. Col. Ellison recently prepared for the Secretary of War a comprehensive report on this subject, which, slightly condensed, reads as follows:

"On May 22, 1917, I communicated with the Secretary of War, suggesting that from my experience with troops I believed that a scheme could be devised whereby the garbage, manure, and waste material at the various cantonments could be handled in a sanitary manner, and at the same time the Government would be able to sell all wastes instead of incinerating them, which has been the general practice in the army for many years past.

"On June 17, 1917, I was ordered to Washington in pursuance to the above communication and reported to Col. I. W. Littell of the Cantonment Division, and was immediately assigned to develop a plan to conserve waste materials at cantonments. As a result the following plan approved by the Secretary of War on Aug. 25, 1917, was formulated:

Wastes Will Be Sorted at Each Camp Kitchen

"At each kitchen all waste materials will be sorted and placed in separate cans, thereby making a complete separation. By this means all of the various materials, such as garbage, bones, fats, grease, paper, tin cans, and bottles, are rendered marketable.

"In handling garbage the two-can system will be adopted. When filled cans are removed from the kitchen they will be replaced with clean cans. All cans will be provided with close fitting covers. These cans will be placed in Government trucks and removed to a transfer station under supervision of the sanitary inspectors. The contents of the cans will then be dumped into the contractor's trucks. The transfer station will consist of platforms and storage sheds together with hot water facilities and tanks for sterilizing cans. At this point all waste materials will be turned over to the contractor who will remove them to a point at least three miles from the reservation.

"In devising this plan for the sale of waste materials, the fact was recognized that some were more salable than others. Consequently, a plan was developed whereby all waste materials except manure were sold at a certain price per capita per month. By this plan all waste materials other than manure at all of the national army cantonments and embarkation camps have been sold. This not only gives a substantial return

to the Government, but will also save $700,000 capital outlay for incinerators and also about 60c. per ton for fuel to burn such waste materials as would accumulate at army cantonments. It is estimated that forty tons of such wastes accumulate each day at each cantonment, and that their incineration would cost $122,275 a year.

Manure Will Yield Large Revenue

"The hardest problem has been to dispose of the manure to advantage. As there are 12,000 animals at each cantonment, manure would necessarily accumulate in large amounts, estimated at not less than 120 tons per day per camp. The cost to the Government of hauling or incinerating this manure would amount to 60c. per ton. At the date of this report, the manure at eleven cantonments has been sold—in some cases on the per animal per day basis, and other on a flat rate per month—resulting in a net return of $240,900.

"The total return to the Government, including money derived from sales and savings over incineration, amounts to $1,725,839.

"From a standpoint of conservation, attention is called to the fact that these waste materials will be converted into valuable commercial products, such as pork, grease, glycerine, soap, paper stock and fertilizing material.

"Garbage from 13 of the cantonments will be fed to hogs. The garbage from 10 to 15 men will feed one hog one day. Hogs will gain on the average of 1 lb. per day on this ration for the first 150 days, according to tests made by request of the War Department by Henry Knight & Sons of Louisville, Ky., at the Chillicothe cantonment. Large rough hogs will do considerably better and gain much more. The garbage from each cantonment should be sufficient to feed 4000 hogs. The hogs on the above average would gain 1,460,000 lb. per year per cantonment. Thirteen cantonments should produce 18,980,000 lb. of pork per year. In the remaining cantonments the garbage will be reduced to reclaim grease, and should yield from 3 to 4 per cent. From this grease, soap, candles, and glycerine are made.

"Heretofore it has been the custom to incinerate all dead animals. According to this plan their hides will be removed and the carcasses degreased and sold for fertilizer material. This will result in increasing the supply of leather, grease, and fertilizer.

National Guard Camps Not Included

"Were it not for the fact that the National Guard camps are considered of a much more temporary character, it would have been possible to adopt this scheme for the disposal of their wastes. Many contractors have made inquiries about the purchase of the waste materials at these camps. These have been referred to the camp quartermasters. The installation of plant and equipment of sufficient capacity to handle all waste materials at a cantonment would cost $100,000 or more."

"The figures given in the above report," Col. Ellison said, in discussing it with the Washington correspondent of *Engineering News-Record*, "were tentative. They have been improved, from the Government's point of view, since the system was put in operation. There has been the greatest opposition to the plan. It seems unbelievable, but the old idea of incinerating wastes is a hard one to down. Not only contractors who have incinerators they want to sell to the Government, but also army officers, who have been accustomed to burning up everything, advocate the use of incinerators. That's old-fashioned sanitary engineering. Nowadays, contractors come into this office with incinerators to sell and before leaving they beg me to let them buy wastes. Formerly I was obliged to go out and show contractors the money they might make; now, I am happy to say, many contractors are bidding against one another, trying to obtain this waste material from the Government."

Who the Contractors at Each Camp Are

The contractors at the 16 cantonments and three embarkation camps are as follows:

Camp Devens, Ayer, Mass., S. A. Meagher & Co., Boston, Mass.
Camp Upton, Yaphank, N. Y., Products Mfg. Co., New York City.
Camp Dix, Wrightstown, N. J., General Mfg. Co., 30 Market St., Philadelphia, Penn.
Camp Meade, Admiral, Md., General Mfg. Co., 30 Market St., Philadelphia, Penn.
Camp Lee, Petersburg, Va., National Contracting Co., Norfolk, Va., Care Virginia Hide & Fur Co.
Camp Jackson, Columbia, S. C., Henry Knight & Son, Louisville, Ky.
Camp Gordon, Atlanta, Ga., Henry Knight & Son, Louisville, Ky.
Camp Sherman, Chillicothe, Ohio, Henry Knight & Son, Louisville, Ky.
Camp Zachary Taylor, Louisville, Ky., Price & Vogt, Louisville, Ky.
Camp Custer, Battle Creek, Mich., United Disposal & Recovery Co., Corn Exchange Bank Bldg., Chicago, Ill.
Camp Grant, Rockford, Ill., United Disposal & Recovery Co., Chicago, Ill.
Camp Dodge, Des Moines, Ia., United Disposal & Recovery Co., Chicago, Ill.
Camp Funston, Ft. Riley, Kan., National Products & Salvage Co., Oklahoma City.
Camp Pike, Little Rock, Ark., Guy Carron, Little Rock, Ark.
Camp Travis, San Antonio, Tex., Valverde Farm Co.
Camp Lewis, American Lake, Wash., U. C. Bates.
Tenafly, N. J., Products Mfg. Co., New York City.
Newport News, Va., National Contracting Co., Norfolk, Va.
Jacksonville, Fla., Henry Knight & Son, Louisville, Ky.

At the time of the interview with Colonel Ellison contract prices for the 19 camps in the list could not be given out, since all had not been computed.

Full-Time Road Patrols in Michigan

Maintenance of the gravel road system in Genesee County, Michigan, previous to a year ago was largely in the hands of farmers who were deputized to drag the roads following rains. Prior to 1914 the county devoted all of its attention to building roads just good enough to receive the state award, but it neglected maintenance to such an extent that this system was found unsatisfactory. The work of the farmers was much criticised. Recently a change was made to the patrol system, thus making it worth the time of a competent man to keep a stretch of road in good condition.

The county gravel roads have been divided into 21 districts, each from 10 to 15 miles long. A man with a team is employed full time on each district. He must keep the roads properly dragged after rains, maintain supplies of gravel along the roadside so that holes may be filled promptly, and care for drainage. A large mileage of the roads was in such poor condition when these men undertook their maintenance that it is hardly possible, with the funds available, to put them into good shape this season. This is particularly the case on account of the difficulty in getting labor, but the fact that the patrolman has steady employment has materially improved the labor situation. The work is on a thoroughly businesslike basis under the county engineer, to whom daily reports are made of work accomplished, and of costs. The reports are preserved and utilized in such a way that any unusual expense is immediately indicated.

Tornado Effects on Structures in Three Recent Storms

Suggestions As to the Design of Dwellings and Small Structures To Resist High Winds Deduced from Observations of Buildings Wrecked by Tornadoes in Middle Western States

By S. H. Ingberg

THE SPRING of 1917 was a period of frequent high winds in the Middle Western States, and was particularly marked by three tornadoes in each of which many buildings were wrecked, and a number of lives lost. The writer visited portions of the three wind-swept areas immediately after the storms and made a study of the effect of the wind for the purpose of considering improvements in design which would make structures more resistive to the sudden and severe stresses imposed by tornadoes. The present article will outline some of the damage observed, and suggest improved details of design.

On Mar. 11, New Castle, Ind., an industrial center of about 15,000 inhabitants, was visited by a tornado that swept centrally through the city, causing the death of 22 persons and severely injuring as many more. The attendant property loss was estimated to be about $500,000, consisting chiefly of residences and greenhouses. The general course of the storm was from northwest to southeast, and the widths within which it proved destructive to buildings varied from 100 to 600 ft. The buildings affected were chiefly of frame construction, with an occasional brick or concrete block residence.

Before reaching the city the tornado hit the buildings of the Indiana Rolling Mills. These were all one story structures of different types of design. The northeastern portion, shown in Fig. 1, was of steel frame and corrugated metal roof, the walls below the windows being of brick, and above of plaster on wood or on metal lath. The sheet-metal roofing and steel-sash windows were generally torn out, but the steel frame of the building remained intact, as shown in the view, the only storm damage that can be noticed being where the steel chimney struck it in falling.

The southeast building of the plant was of heavy timber construction with long span roof trusses and corrugated iron roofing and siding. This was completely demolished, as was also the southwest building, which was of light, short-span timber construction with sheet-metal sides and roofing. The office and storage building had brick walls laid in double thickness of 4 in. each, with ½-in. air space between the two. Parts of the wall and the roof of the eastern wing of this building were torn out. A steel water tank inside the plant area, which was full of water, apparently withstood the full impact of the storm, probably due to its laterally braced frame support.

In the city proper the wreckage was generally confined to residences. Fig. 2 shows some of the worst storm effects in this section. Brick residences withstood the storm with less damage than frame, although the latter were so much more numerous that definite conclusions are not possible. In some blocks where the storm was particularly intense, all the houses within the whole block were leveled.

A brick school building, shown in Fig. 3, was pretty well wrecked. Fortunately no one was in the building. This building is of the ordinary brick exterior with frame interior. The roof was lifted off and all the windows were blown out. One house with hollow concrete block walls 8 in. thick stood up fairly well, although surrounding wreckage would indicate that it received the full impact of the storm. The walls and the floors remained in place, though the frame roof was destroyed. Six persons who were in the house when the storm struck were uninjured.

One particular form of damage was the entire removal of a house from its foundation and its consequent wreckage. Another common form was where the wall on the side away from the source of the storm was wholly or partly blown off. This leeward wall failure was common in all three of the storms observed. In every case where houses were completely blown from

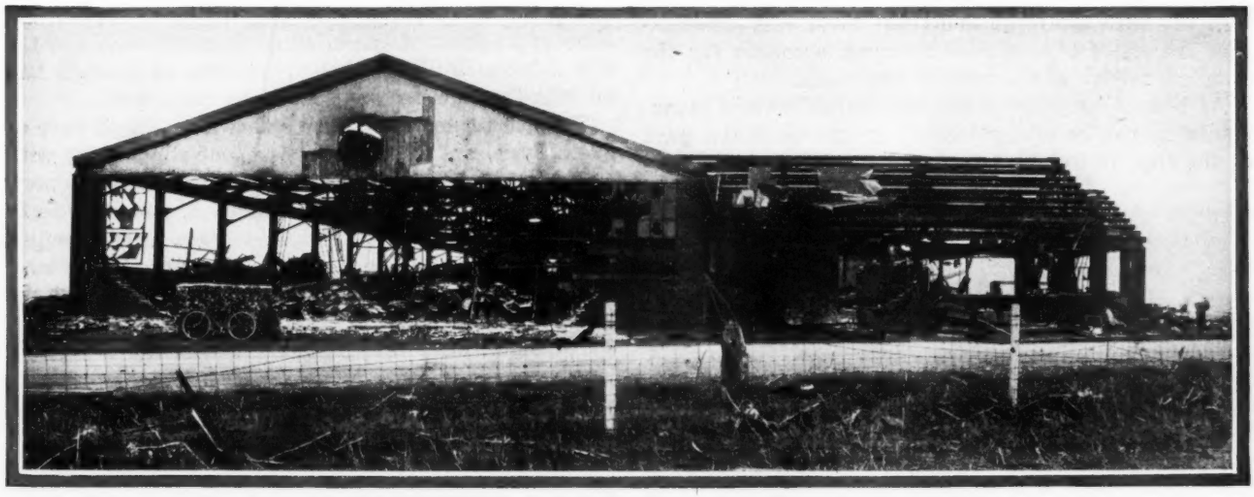


FIG. 1. WALLS AND WINDOWS OF FACTORY BLOWN OUT BUT STEEL FRAME INTACT

FIG. 2. HOW A TORNADO THROWS FRAME HOUSES AROUND

their foundations, there was no evidence of any anchorage between the frame and the foundation, which if present might have prevented complete failure where the foundation was heavy enough to supply the required resistance.

On Mar. 23, another tornado passed through a part of southern Indiana causing heavy loss of life and severe property damage in New Albany, Ind., a city of about 21,000 inhabitants, on the Ohio River opposite Louisville. Here the destructive portion of the storm varied in width from 1000 to 4000 ft. The number of deaths was about 40 with 50 cases of severe injury, and the damage to property is estimated at $1,100,000. As in the case of New Castle the downtown business section was spared, the area devastated covering outlying residence and manufacturing districts.

The general direction of the travel of the storm was from southwest to northeast, and as in the other case practically all the damage was in small brick and frame houses, although where larger structures were in the path of the storm they suffered more or less.

An instance of a factory building is shown in Fig. 4. This building has walls of concrete blocks, the hollow spaces of which were filled with concrete reinforced with twisted square steel rods. The blocks of the lower story are 12 in. thick, and those of the upper 8 in. thick. The vertical wall reinforcement was evidently not continuous at the second-floor line. This, together with the large undivided room area, open except for the roof and roof framing, accounts for the complete failure of the second-story walls.

At New Albany the storm overturned several monuments in the cemetery located in the northern part of the city. Of eight fallen monuments of the heavier type that were examined, three fell toward the northwest, two toward the west and one each toward the north, northeast and east, which, as far as it goes, confirms the presence of the whirling air motion generally associated with tornadoes, since on this assumption only is it possible to have strong air currents flowing in different or opposite directions over the same locality in the brief space of time required for the passage of the storm.

FIG. 3. TYPICAL SCHOOLHOUSE BUILDING IS WRECKED

On May 26, a tornado passed through south central Illinois and Indiana, causing heavy loss of life and property damage, two large centers of population in its path being the neighboring cities of Mattoon and Charleston, Ill. The widths of the devastated areas here averaged about 1800 ft., the general direction of travel being nearly due east. In both cities the main business district is outside of the storm's path, although in Charleston two railroad depots and some warehouses adjacent to them were destroyed. The total number of fatalities in Mattoon was 65, and in Charleston, 35, most of whom were killed by falling or flying timbers and débris.

The buildings wrecked in the stricken area of Mattoon numbered about 800. They were chiefly of light frame construction. Some of the foundations were of single brick 4 in. wide, which gave neither anchorage nor stability. Many of them were lifted entirely from their foundations and carried some distance away. Such a house is shown in Fig. 5. This was blown 15 ft. south, and is the only building standing within several blocks. None of its inmates was injured. In another part of the city a house with 8-in. hollow concrete block walls laid up with lime mortar was completely destroyed.

FIG. 4. CONCRETE BLOCK WALLS HAD HORIZONTAL JOINT AT SECOND STORY

The overturned roof trusses shown in Fig. 6 were of 80-ft. span, and rested on 12-in. one-story walls with a pilaster of 4 in. added thickness at points of support. The roofing supported on these trusses, rested on 2 x 8-in. stringers spanning between trusses and toe-nailed to the top chord of the trusses. The only other lateral bracing was one 6 x 8-in. timber similarly secured to the top chord at each quarter point.

The public utilities system of Charleston was severely hit, both the gasworks and the electric plant being put out of commission. Fig. 7 shows the former, which was almost completely wrecked, and in Fig. 8 is shown the wrecked part of the electric plant. The brick walls of the latter had an air space, as shown in the view, which materially weakened their resistance to the storm.

FIG. 5. TYPICAL EXAMPLE OF SMALL HOUSE PICKED FROM FOUNDATION

FIG. 6. INSECURELY BRACED TIMBER TRUSS ROOF IS BLOWN DOWN

A three-story frame hotel located near the Big Four Ry. was wrecked, while an elevated signal tower, one block to the west of the building and in the direct line of the storm, was practically undamaged. The tower was of wood, braced with rigid iron and timber framing.

The tornado motion is a combination of rotation and translation. The direction of the whirl, as far as it concerns the storm areas in our own country, is generally conceded to be anti-clockwise and the general course of the tornado toward the east. It will be evident that the highest wind velocity obtains in the southerly parts of the whirl, since here it is the sum of the two velocities of translation and rotation. Of the two the latter is generally the largest component, since the forward movement seldom exceeds a speed of 40 miles per hour.

Considering the large size of the tornado whirl with respect to that of most structures in its path, its action as far as wind effect is concerned must be similar to that produced by a straight air current of equal intensity. Whether or not the low air pressure supposed to exist in the whirl has any damaging or so-called explosive effect on buildings is difficult to determine, since the amount of the diminution cannot be ascertained, and the relatively slow approach of the whirl as a whole permits full or partial equalization of pressure as between the room spaces of buildings and the outsides. Most of the storm effect attributed to this cause can be readily explained on the basis of direct wind pressure. As the effects on structures and methods of making them more resistive to storms does not depend primarily on theories of storm action, the matter is best approached from the standpoint of linear air motion.

The familiar expression for total wind pressure, expressed in terms of wind velocity in miles per hour is, in pounds per square foot, $P = 0.004v^2$. For surfaces as large as those presented by buildings, the average pressure will be lower than that indicated by the above expression.

On analyzing the necessary upsetting moment on the cemetery monuments noted earlier in the article, it was found that for the three that fell toward the northwest the computed total unit pressures required for overturning were 27, 31 and 37 lb. per sq.ft. respectively, for those falling toward the west, 29 and 31 lb. per sq.ft. respectively, and for each of the ones falling toward the north, northeast and east, 45, 39 and 20 lb. per sq.ft. respectively. The higher pressures obtained for those falling toward the north accord with the presence of an anti-clockwise whirl, since their location was in the right or southeast part of the path of the storm whose general progress was toward the northeast. According to the foregoing formula these pressures would give velocities varying from 70 miles per hour for the 20-lb. pressure to 106 miles per hour for the 45-lb. pressure.

It is difficult to analyze the method of destruction when that destruction is as complete as it was in a number of small dwellings. More information can be gained from cases where the destruction was arrested at an intermediate stage.

In the case of frame construction two distinct forms of this intermediate stage can be discerned. In one, the house was blown off its foundation and totally or partly wrecked by the resulting impact and racking strains. A little calculation will show that frame houses have not sufficient weight to resist wind velocities of tornado intensity without anchorage to substantial foundations. The weight reaction of the house on the foundation is often reduced at the moment of wind impact, due to the blowing in of windows and doors on the windward side, which may momentarily cause uplift pressures equal to the impact pressure of the wind, thus greatly decreasing the resistance of the house to sliding.

In the other case the house is destroyed in place, the weaker parts giving away first. The blowing out of the wall on the leeward side is of frequent occurrence. After the wind obtains access to the inside of the house this wall is subjected to both the impact and negative-pressure components of the wind, and also generally obtains less support from the floor framing, partitions and walls, than is the case for the wall on the windward side. This is particularly true where the floor joists and roof rafters are parallel with it.

Brick and other forms of heavy block construction are similarly destroyed in place by lifting of roofs and overtopping or piecemeal destruction of the walls.

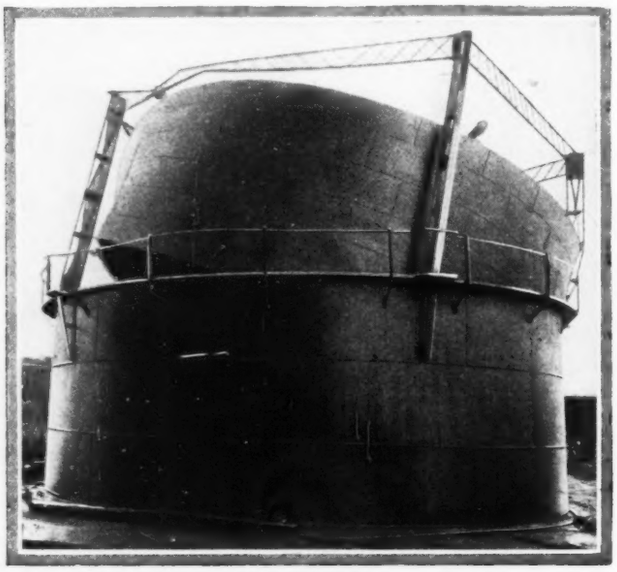


FIG. 7. GAS-HOLDER BLOWN OVER BY WIND

While it may be impossible to make all types of buildings fully resistive to storms of tornado intensity, much can be done to make them more resistive, and thereby reduce the large loss of life and property damage which is incident to tornadoes. A building whose walls and floors remain in place is a safe refuge, even if it is damaged so as to make it almost useless for purposes of subsequent habitation. The outside during the storm is filled with objects flying and falling with great velocities, and the wind pressures are such that human beings are freely blown about. These pressures are, perhaps, rarely in excess of 60 lb. per sq.ft., so that structures designed for wind pressure of 30 lb. per sq.ft., with a factor of safety of two or more, come through intact, as far as main structural members is concerned, which accords well with the performance of engineering structures in storms.

As previously indicated, frame construction is too light to maintain itself in place of its own weight, and must be anchored to substantial concrete or masonry foundations. The resistance of a light concrete foundation can be increased by a footing offset around the outside, thereby utilizing the weight of some of the surrounding earth fill and also increasing the bearing power of the foundation. The anchorage must be designed to prevent both uplift and sliding, the strength to be proportioned according to the height and area of the building, using as horizontal pressure 30 lb. per sq.ft. of vertical projection and as vertical pressure 20 lb. per sq.ft. of horizontal projection, subtracting in each case the dead-load resistance of the construction, and using working stresses with a known factor of safety of two or more.

While calculations of the kind are seldom made for this type of construction, empirical rules accomplishing the desired object can be embodied in state and municipal ordinances in regions where tornadoes and other severe storms are of probable occurrence. The experimental knowledge on strength of anchors in concrete and masonry, as well as that of bolted and nailed timber joints, is now such that strength calculations can be made with a fair degree of accuracy. Most woods have an ample amount of strength if properly utilized.

The transverse strength of frame construction can be increased by proper utilization of the sheathing and, where openings occur, by bridging diagonally between uprights. The walls should be secured into the floors and partitions at intersections, and the roof into the walls at the eaves, the latter by means of outside or inside braces extending downward to the studs or uprights. The end walls can be securely tied by notching an outside joist partly into the studs even with the sheathing and extending the floor boards for nailing into it. This also serves the purpose of a fire stop, where no other is provided. The roof sheathing should be laid up close and be well nailed to the rafters to resist the lateral and upward pressures and prevent the latter from carrying away the roofing material.

Long-span timber truss work should have properly proportioned diagonal bracing and be anchored into side walls of sufficient stability and weight to take care of the uplift and side pressure. The framework of steel mill buildings is quite generally designed to transmit a lateral pressure of 30 lb. per sq.ft. of vertical projection into the ground with working stresses; and, in the one case in point at New Castle, such construction stood up intact while adjoining long-span timber construction was completely wrecked, there being nothing in this incident that shows that the latter would not have stood up equally well if it had been designed for the same external forces.

FIG. 8. ELECTRIC-LIGHT AND POWER PLANT WRECKED

Brick and concrete blocks in exterior walls should be laid in portland cement mortar, and, for buildings of more than one story, should be not less than 12 in. thick and be well bonded at corners and floor lines. Where large, undivided areas occur, with high walls, the latter should be figured for the given lateral pressures acting as cantilevers, with tensional stresses within safe limits. Mullions between windows act as beams, resisting the forces acting on both window and mullion. Windows and doors of ordinary design are unable to withstand the full force of a wind of tornado intensity, but from the standpoint of safety to the lives of those within, this does not appear very serious, to judge from several incidents in these tornadoes.

Selection of Materials for Sea-Water Concrete

Any Standard Portland Cement May Be Considered Safe, as May Also Sea-Water Gaging—Great Care Should Be Exercised in Choosing Aggregate

By Rudolph J. Wig and Lewis R. Ferguson

Fourth of Five Articles on the Problem of Sea-Water Concrete, Written as a Result of Investigation and Inspection of Practically All the Marine Concrete Structures in the United States.

In THE previous articles the authors have shown that unless protected against abrasion plain concrete is apt to disintegrate following the chemical attack of sea water on the softened interior, and that reinforced concrete is subject to percolation which permits the rusting of the reinforcing steel and subsequent failure of the concrete. It is therefore necessary, in order to resist this action, to have as good, dense concrete as possible and to reject any material, be it cement, aggregate or water, which may tend to accelerate the sea-water disintegration. In this article will be taken up the selection of the various materials.

All well-made portland cements will resist disintegration in sea water *if properly used.* This statement must be defended, as many engineers are of the opinion that no cements are durable in sea water, or at best only such cements as have some peculiar composition. This belief is founded largely upon laboratory tests or investigations made under abnormal conditions of test, or a misinterpretation of data obtained from the chemical analysis of concrete which has disintegrated in sea water. No more conclusive evidence is required by the engineer to support the statement that all well made portland cements will resist disintegration in sea water if properly used than the fact that concrete structures have been standing in sea water for the past 30 years and more without showing any deterioration. Let us see what the experience has been with portland cements of widely different composition.

During the period from 1888 to 1890 many concrete bridge piers were built along the Bay of Fundy in Nova Scotia by the Dominion Atlantic Ry. and the Provincial Government. White Brothers English portland cement was used, and these piers, where protected from abrasion or not exposed to severe erosion, are in excellent condition, as shown in Fig. 1.

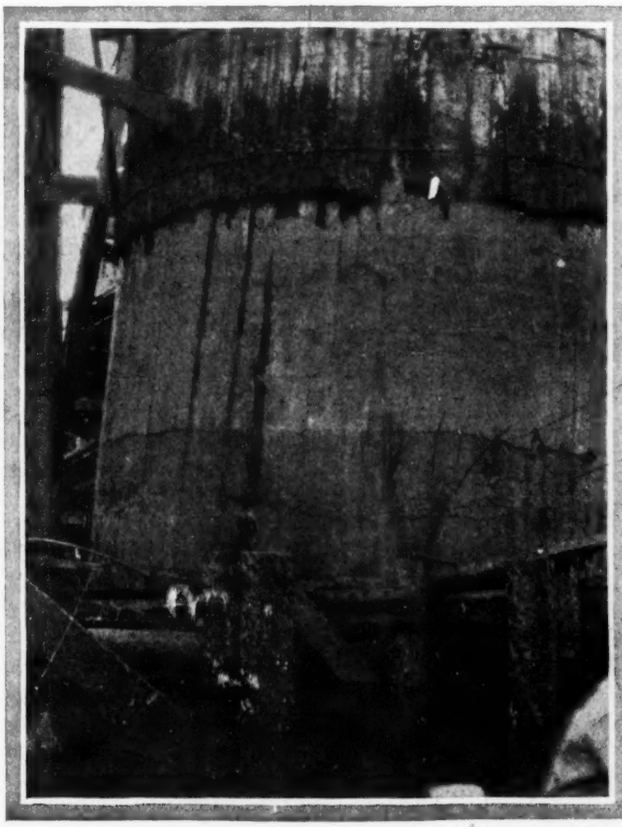


FIG. 1. THIS PIER WAS BUILT OF ENGLISH CEMENT 25 YEARS AGO. BEING PROTECTED, THE CONCRETE IS STILL GOOD

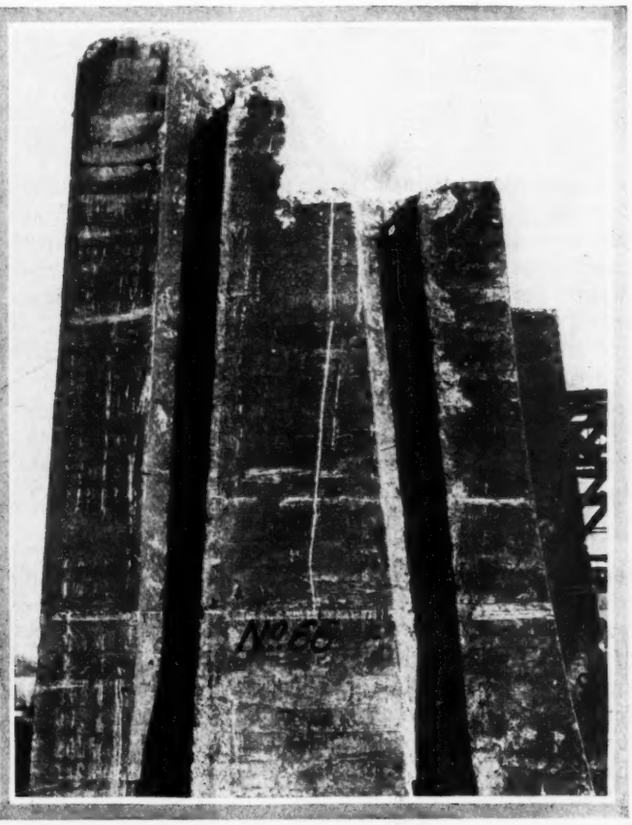


FIG. 2. CONCRETE BLOCKS SUBMERGED IN NEW YORK HARBOR 10 YEARS. NO DISINTEGRATION VISIBLE AFTER REMOVAL TO AIR

In New York harbor are several miles of bulkhead walls of which the substructure is made of precast concrete blocks weighing from 40 to 80 tons. These walls were built at various periods dating from 1877 to the present, and various brands of portland cements were used. Two of these blocks were raised after immersion for 10 years, and their perfect preservation can be seen from the view shown in Fig. 2.

At different times from 1892 to 1900 cement-mortar jackets were placed around the wood piles of the Spreckels wharf at San Diego, Calif. Fig. 3 shows, in excellent condition still, the top of one of these jackets, placed in 1892.

There are a great number of structures built since 1900 which show this same excellent preservation in sea water; in fact there are no authentic cases of disintegration of concrete which is at all times wholly immersed that are not accounted for by the use of poor materials or workmanship. Among the cements used in the concretes which have shown practically no deterioration after a long period of exposure are those given in the accompanying table. An examination of this table shows that the composition varies between relatively wide limits—particularly the alumina, magnesia and sulphur trioxide, which are the three elements which are generally considered very deleterious by many engineers.

CHEMICAL COMPOSITION OF CEMENTS USED IN CONCRETE WHICH HAS RESISTED SEA-WATER ACTION

Brand	Percentage of Various Constituents							In. Res.
	SiO_2	Fe_2O_3	Al_2O_3	CaO	MgO	SO_3	Loss	
Alpha	20.88	2.65	7.89	62.54	2.62	1.23	1.06	0.27
Atlas	21.30	2.55	7.35	61.48	3.21	1.53	1.77	0.22
Dykerhoff (German)	21.52	2.90	6.54	62.96	2.41	1.40	1.76	0.27
K. B. & S. (English)	19.75	5.01	7.48	61.39	1.28	0.96		
Lehigh	22.70	2.30	5.72	63.04	3.19	1.59	0.93	0.19
Old Dominion	20.82	2.65	6.95	62.66	2.68	1.62	2.20	0.40
Phoenix	21.82	2.20	6.44	62.76	3.23	1.58	1.55	0.30
Pennsylvania	21.84	2.30	6.14	62.38	3.91	1.61	1.29	0.45
Rosendale (Natural)	25.80	4.60	11.44	33.51	16.38	1.10	7.41	
Santa Cruze	22.26	1.85	8.23	63.48	1.64	1.72	1.23	0.41
Vulcanite	22.76	2.18	7.58	62.98	2.09	1.30	0.98	0.15
Washington	22.96	1.90	4.64	64.38	1.84	1.38	2.71	0.28
White Bros. (English)	21.17	4.14	7.35	61.94	0.91	1.38	1.65	0.87

Providing the cement is properly manufactured, one containing 8% of alumina will resist sea-water action just as well as one containing only 4%. The solubility experiments made by P. H. Bates, as noted in Technologic Paper No. 12 of the Bureau of Standards, show that a cement containing only 3% of alumina and 7.5% of iron oxide may be even more soluble in sea water than one containing 8.5% of alumina and less than 1% of iron oxide. The most convincing proofs to the engineer, however, are the many structures which have been made of cements containing more than 7% of alumina and have withstood sea-water action for a period of years without disintegration or deterioration.

Many engineers have an idea that magnesia is deleterious in cement because when a sample of concrete which has disintegrated in sea water is chemically analyzed it is found to contain a relatively high amount of this material. If a comparison had been made of the amount of magnesia in the cement used with the amount found in the concrete after disintegration had occurred it would have been found that the magnesia content had materially increased.

The increased magnesia found in the disintegrated concrete is precipitated from the sea water as a magnesium hydroxide. The magnesia in the cement originally is wholly inert to the sea water and in fact may be

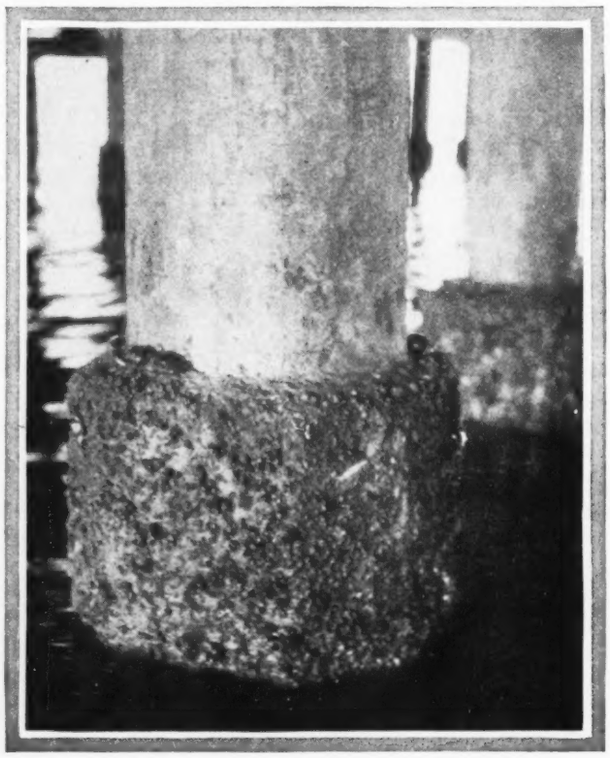


FIG. 3. MORTAR JACKET EXPOSED TO SEA WATER 22 YEARS. NO DETERIORATION. CEMENT HAS 7 PER CENT. ALUMINA

considered one of the most stable elements of the cement. For use in sea water it is really preferable to have the magnesia run as high as permissible without causing unsoundness; that is, about 8 per cent.

So many structures have been built in sea water of cements containing from 3 to 4% (the maximum permitted by American specifications until 1917) of magnesia that are now wholly sound where not exposed to abrasion that the evidence is conclusive from the practical as well as the theoretical and laboratory source. Magnesia within limits is not a deleterious element in the cement.

Until 1917 the American specifications limited the sulphuric trioxide content of cement to 1.75%. Therefore practically no cements have been used in sea water in this country which contained more than this quantity, and the majority of American cements range between 1.30 and 1.60%. Most of the sound structures on the North American coasts are made of such cements, which is evidence that up to this limit, at least, the sulphuric trioxide is not detrimental.

There are concretes that have been standing in European waters for 10 or 15 years, which are made of cements containing from 2 to 2.5% of sulphuric trioxide, without showing any evidences of disintegration below the water line. Solubility tests made by P. H. Bates show that there is no difference in the solubility in sea water of cements containing varying amounts of sulphuric trioxide up to 1.75%, this being the maximum amount in the cements he investigated. Thus all available data on this subject concord and show that there is no advantage in limiting the content of sulphuric trioxide below 2%, which is now allowed by American specifications.

The most vulnerable and chemically active material in a cement when exposed to sea water is the lime, which comprises 60% or more of the composition. It is not possible to decrease the quantity of lime in the cement appreciably without destroying its cementing and hydraulic properties.

To summarize, it may be stated that, contrary to the opinion of many, there is no definite relation between the chemical composition of properly manufactured portland cements and the ability of concretes made from them to resist disintegration in sea water. If properly manufactured and properly used, all normal portland cements are durable in sea water. The constituents of such cements generally range between the following limits: Silica, 19-25; alumina, 4-9; iron oxide, 2-6; lime, 60-65; magnesia, 1-5; sulphuric trioxide, 1-2.

Sea Water Can Be Used in Mixing

Sea water or brackish water can be used for mixing unreinforced concrete without deleterious effect. Nothing but fresh water, however, should be used in mixing concrete above water which is to be reinforced. The salts contained in sea water have no appreciably deleterious effect upon the chemical action which takes place when cement sets. In reinforced work, however, the presence of the salts may have an injurious effect upon the embedded metal in accelerating corrosion above the water line.

A study of what has been done and the results obtained will throw much light on this phase of the subject. Practically all of the concrete structures built along the Bay of Fundy in Nova Scotia were made of concrete gaged with sea water. In Fig. 1 is shown a bridge pier on the Bay of Fundy. These structures have been personally examined by the writers and are in excellent condition except where abraded. The concrete is of excellent quality and shows no peculiar characteristics which would indicate that sea water instead of fresh water had been used in mixing.

The one extensive American operation upon which sea water was used in mixing the concrete is that of the Florida East Coast Ry. for the work between Homestead and Key West, Fla. (See Fig. 4.) Several hundred pier structures have been built since 1909, involving several hundred thousand yards of concrete, practically all of which has been gaged with sea water. These structures, while not very old, show no deleterious effect whatever from the use of sea water.

A. B. Fletcher, state highway engineer of California, has used sea water in mixing concrete used in road construction without any effect on the quality of the concrete.

There have been a number of small marine structures built in this country in which the concrete was gaged with brackish or undiluted sea water, but no other extensive works. American specifications have quite generally required the concrete to be mixed with fresh water, and so we shall have to turn to foreign structures subject to sea-water action to see what the effect has been of mixing sea water with the concrete.

Sea water was used in mixing concrete for the construction of the marine railway piers in Algoa Bay by the government at Port Elizabeth, South Africa, in 1902. This pier was in excellent condition in 1914 and showed no defects which would indicate that the sea water was detrimental. There are numerous other extensive marine structures in good condition in this same district which were built at different periods since 1878, and it has generally been the custom for the government to use sea water for mixing concrete for this class of work.

A half-and-half mixture of sea water and fresh water was used in mixing the concrete for the quay walls and breakwaters at Saloniki, Greece, constructed prior to 1906 by a French syndicate. These works were all reported to be in excellent condition in 1914 where not abraded.

The Government of Tasmania used sea water in mixing the concrete for the construction of the Huon lighthouse in 1906. This was reported to be in good condition in 1915 and showed no deleterious effect from the use of sea water.

British specifications have generally, for many years, permitted the use of sea water for mixing unreinforced concrete. Among specific cases may be cited the sea wall built in 1909 at Methil, on the Firth of Forth, about 18 miles northeast of Edinburgh. This was reported in 1915 to be in good condition. The specifications of 1913 for the new works of Aden Port Trust, Aden, Arabia, state that "the water for mixing concrete may be sea water"; also those for the extensive sea wall and dock works at Rossyth naval base on the north shore of the Firth of Forth, about five miles south of Dumfernshire, Scotland, and for the dock at Newport, Monmouthshire, England, which was built in 1905, sea water being used in mixing the concrete.

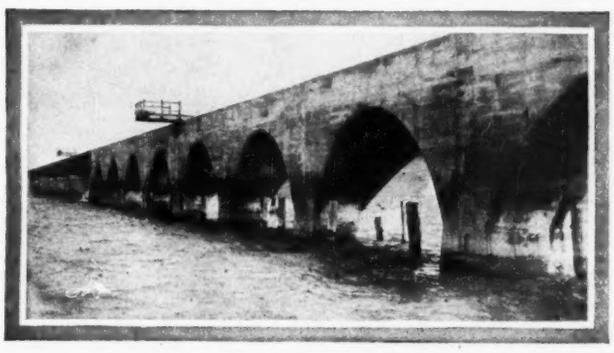


FIG. 4. CORAL SAND AND ROCK WERE USED IN FLORIDA EAST COAST PIERS, AND GAGING WAS DONE WITH SEA WATER, BUT CONCRETE IS IN GOOD CONDITION

Where sea water is used less than 0.1 lb. of cement is required to react with the salts in each gallon of water. If large masses are being poured and the concrete is mixed very wet, a larger quantity of laitance will accumulate on the surface of the concrete than if fresh water were used. This added laitance consists mainly of magnesium hydroxide precipitated from the sea water.

If proper construction methods are followed there will be no difference in the appearance, workability, or resulting quality of unreinforced concrete, whether gaged with fresh or sea water.

It is well known that under conditions where oxidation of the steel can occur the presence of sea water has a most marked effect in hastening corrosion. That the corrosion of the steel is occurring in the exposed section of many reinforced-concrete structures in sea water has been fully set forth in an earlier article, and there-

fore if sea water is used in mixing the concrete it will accelerate the oxidation. If the structure is exposed to stray electric currents the deleterious effect of the presence of the sea salts will be still more strongly emphasized, and disintegration from electrolysis may be rapid.

The same rules that apply to selecting fine aggregate for land structures also apply to concrete structures exposed to sea water, except that in Northern latitudes the sand should be selected so that it will produce a

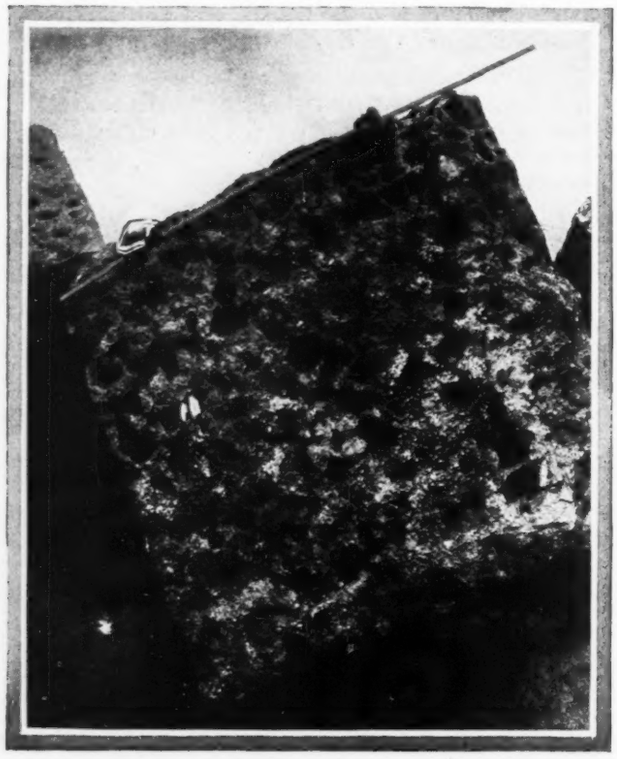


FIG. 5. CONCRETE BLOCKS AT PANAMA SHOW PITTING WHERE MECHANICAL EROSION TAKES PLACE

concrete of minimum porosity which will offer the greatest resistance to frost action. This practically eliminates natural sands and stone screenings containing large quantities of fine particles or dust, and also soft or porous aggregate.

In the South where there is no frost, uniform, fine sea sand and relatively soft limestones, coral rocks and shell sand are successfully used. The relatively soft, so-called coral sand found off the Florida Keys has been and is now being successfully used by the Florida East Coast Ry. in its very extensive marine structures, and by the United States Navy at Key West. Fig. 4 shows some of the concrete piers of the Florida East Coast Ry. in which coral sand and rock were used as aggregate.

Seashore sand was used in making the concrete jackets on the wood piles at San Diego previously referred to and illustrated in Fig. 3. It has been successfully used in a number of other marine structures in the South. Shell sand was used in the construction of sea walls at Port Royal, S. C., built in 1899 and 1900. These walls, though poorly constructed, are still in serviceable condition. Some seashore sand was used in the construction of the piles of Municipal Pier at Santa Monica, Calif. This sand contained a small quantity of shale. These small pieces of shale have swollen in the concrete, causing it to crack and spall even though embedded as much as an inch from the surface.

It is always safe to use well graded, clean, hard sand, but under certain conditions successful and wholly satisfactory work can be done in Southern latitudes with sands which would generally be considered wholly unsatisfactory. Where extensive works are contemplated it will pay to make a careful study of the available fine aggregate.

The statements made relative to the hardness of fine aggregate also apply to coarse aggregate. That is, in Southern latitudes under certain exposure conditions softer aggregate may be used than would be permissible in the North where frost conditions exist. Shale or other material which will expand when exposed to water and air should, of course, never be used. The partial or complete failure of several concrete structures has been caused by the use of aggregate containing only a small quantity of shale.

In 1886 the French made, at Panama, 580 concrete blocks of 1:2:3 mixture using portland cement, beach sand and conglomerate argillaceous sandstone. The blocks were used in shore protection at Cristobal. Fig. 5 shows some of these blocks as they appeared in 1910. The holes seen here and there over the surfaces are caused by the disintegration of the embedded aggregate. The markings on the original surfaces are plainly visible on some of the blocks.

Some engineers will not use limestone as aggregate because they believe it disintegrates in sea water. But limestone, which is a calcium and magnesium carbonate, is stable and insoluble in sea water, and is therefore safe to use.

Gravels are preferable to crushed-stone aggregate, particularly for underwater work, because they mix and settle into place more easily. Either crushed stone or gravel may be used, however, if carefully handled. Bank-run gravel should never be used, as its quality is not uniform.

How About Waterproofing Materials?

With the failure of concrete structures in sea water engineers have experimented with waterproofing compounds as a possible remedy. Structures were examined in which a number of these materials were used, such as Toxement, Impervite, Keystone, Trus-Con, Hydrolithic, Wemco, Medusa and others. In no case was there any difference in the appearance of the structure which would indicate that a waterproofing compound had been used, the same defects and deterioration being present in the treated structures as in those untreated.

In one case many concrete piles had to be discarded on account of the reduction in strength due to the use of a waterproofing compound. The piles were remade without the compound and were driven without breakage.

Complete failure of concrete containing compounds has also occurred in certain cases. Reinforced concrete containing waterproofing compounds has cracked and deteriorated in the same manner as the untreated reinforced concrete. It appears that at best waterproofing compounds are of doubtful value and their use is not recommended.

To sum up this matter of the effect of materials used in concrete subjected to sea-water action it may be stated that:

1. All well made portland cements will resist disintegration if properly used.

2. The gaging of the plain concrete with sea water will not be deleterious if proper methods of construction are followed.

3. Aggregates should be carefully selected, particularly with the idea of securing density and toughness. although in localities where there is no frost action local materials, of what might be considered inferior quality, may be successfully employed for unreinforced work. Where the conditions are severe, as along the north Atlantic coast, only the very best aggregate will produce concrete able to resist the action of the sea water.

4. Waterproofing compounds have no beneficial effect.

Good Rails the Result of Inspection

RAIL INSPECTION as an aid to securing good rails was dealt with at the recent annual meeting of the Roadmasters and Maintenance of Way Association, held at Chicago, in a paper by C. W. Gennet, Jr., manager of the rail inspection department of R. W. Hunt & Co. The present detailed system of inspection of the steel and the rails was inaugurated in 1912, after the rail failure record of a severe winter had called attention to the necessity of closer supervision of rail manufacture. It includes the employment of inspectors day and night in each important department of the mill. These inspectors, employed because of their experience with the work of the department to which they are assigned, act as monitors in that department. Thus there are openhearth or Bessemer steel inspectors, blooming mill inspectors, rail mill inspectors and drop test inspectors. Each man keeps an individual record of the work of his department, and his reports become part of a complete record of each heat of steel made and the treatment it later receives in the rolling process.

Mill Inspection System

This record begins in the open-hearth or Bessemer works, and is passed on to the inspectors in the succeeding departments. Thus each one in turn is able to anticipate just what conditions are to be met. The men are instructed not to interfere with the operation of the mills in any way except by appealing to the moral responsibilities and obligations of those in charge. This they do by first reporting verbally to the foreman any deviation from recognized good practice, and then confirming that report in writing to the higher officials in charge. Immediate opportunity is therefore afforded the manufacturer to divert the metal affected by bad practice or workmanship to other uses or orders, and to take such action as will prevent shipment of the rails which might otherwise go forward.

This feature of the mill inspection system has resulted in the greatest check imaginable on errors of mill practice and lack of judgment due to the employment of workmen on the tonnage basis. Mr. Gennet pointed out that the workmen apparently realize that an inspector watches every move, with the interest of the final purchaser of the rails so much at heart that any evident carelessness or lack of good judgment may be promptly reported to the officials and consequent disciplining result. This also has been the principal feature of special inspection that has so largely appealed to the officers of the manufacturing companies, for they, unquestionably desiring to make and ship only rails of the best quality and workmanship possible, have been quick to appreciate the great advantage gained from such a system.

Many cases show the advantages of special inspection. For instance, the open-hearth inspector complains of the general appearance of the steel as it comes from the furnace, possibly from the treatment it has received there. Its analysis proves correct and the mill decides to roll it into rails. At the drop test some of the pieces break and others stand. But in further testing the preponderance of broken test pieces and their appearance are such that the mill decides to take no chances and to reject the whole heat, even though under a strictly literal interpretation of the specifications it might be accepted.

Complete Record of Manufacture and Tests

The reports of the special inspectors are accumulated eventually and made up to comprise a complete record of each heat rolled. This is furnished to the purchaser as desired. A splendid opportunity is thus afforded for keeping definite record of the data concerning the manufacture of each heat of rails and the later serviceability of those rails.

In fact, Mr. Gennet stated that a plan has been advanced whereby the linking together of the manufacturing record with the failed-rail records might afford great benefits in the solving of the ultimate problem of what constitutes good rails. This plan has not yet been taken advantage of except in isolated cases, but he thinks that undoubtedly it will be adopted more generally by the railway companies.

The inspection during manufacture, above outlined, is additional to the usual inspection of the finished rails which for many years has been and is now applied. The rail inspectors go over carefully each rail in a search for flaws, seams and similar surface defects, as well as to examine the mechanical finish of the rails.

In this they are greatly assisted by the results of the special inspection, for word may come to them from the men in the open-hearth or blooming mill or rail mill that some condition has occurred and to be on the lookout for evidence of that condition in the finished rails.

Thus the inspection work is progressive from the time the furnaces are charged until the rails are on cars ready for shipment. Of course, the chemical composition and the physical test specified must continue to bear an important part in the effort to make good rails.

Airing a Reservoir Bottom

Spirogyra caught on the shallower parts of the 15,000,000-gal. impounding reservoir of Windsor, Conn., caused bad odors in the water-supply, according to a paper by Homer R. Turner, superintendent and engineer, read at the recent convention of the New England Water-Works Association. The reservoir was drained, thus exposing the bottom to air and sunlight. After ten days' exposure "the offensive matter was sufficiently oxidized so the sluice gates could be closed."

To Meet State Laws Austin Proposes Thoroughgoing Sewage Works

Automatically Controlled Pumps, Imhoff Tanks, Sludge-Drying Beds, Four Dosing Tanks, Trickling Filters and Liquid-Chlorine Disinfecting Apparatus Are Included in Design

By John H. Gregory
Consulting Engineer, New York City

TO COMPLY with the laws of the State of Texas, which prohibit the pollution of watercourses within the state by the discharge into them of untreated sewage or other polluting wastes, and to meet occasional low river-flow conditions, the City of Austin, the capital of the state, has recently had plans prepared for thoroughgoing sewage works. It expects to proceed with the construction of the works as soon as funds are available. Austin, which is sewered on the separate system, is situated on the Colorado River, into which the sewage is now discharged without treatment. Notwithstanding a drainage area of some 37,000 sq.mi. above Austin, the flow in the river below the city is, at times, exceedingly small. Flows as low as 40 sec.-ft. have been observed for days at a time; and during one period of 31 consecutive days the average flow was as low as 77 sec.-ft. It was conditions such as these which determined the type of works to be installed.

The sewage works (see plan) will consist of a diversion chamber, pumping station, Imhoff tanks and sludge-drying beds, dosing tanks and trickling filters, and apparatus for disinfecting the effluent with chlorine gas, when and as may be required. The works will have a capacity of treating an average of 2,500,000 gal. per 24 hours, but are designed to handle the sewage at a maximum rate of 4,600,000 gal. per 24 hours, or at about 85% in excess of the average rate of flow. The present population of Austin is about 37,000, but the works have been designed to serve for a period of years before extensions will be necessary.

Diversion Chamber in Existing Sewer

The sewage at present passes out to the river through the existing Holly St. sewer. On this sewer, at the site of the works, a diversion chamber will be built, where the sewage will be intercepted and diverted into a so-called inlet sewer, through which it will flow to the suction well of the pumping station.

After having passed through the works, and after having been treated with chlorine gas or not, as the case may be, the sewage returns to the diversion chamber and passes through it back into the Holly St. sewer, just below the point at which the raw sewage is diverted. It then flows through the lower end of this sewer, being discharged into the river through a submerged outlet.

In the diversion chamber, by means of stop planks and suitable openings in the diverting wall, the raw sewage can be caused to flow continuously through the Holly St. sewer, instead of being diverted into the inlet sewer, thus bypassing the sewage works entirely, should repairs or extensions require such a temporary method of operation. Automatic relief is also provided for allowing the raw sewage to flow into the lower end of the Holly St. sewer in case the pumping station should be shut down without the stop planks in the diverting wall first having been raised. The diverting wall also serves to prevent the river from backing up and flooding the Holly St. sewer during periods of freshet.

Screen and Suction Well

From the inlet sewer the sewage flows into the suction well, at the entrance of which the screen is located. This is of the bar type, the bars being spaced ¾ in. apart in the clear. The individual bars of the screen, and the upper and lower racks holding them, are removable, so that by the insertion of other racks the spacing between bars can be easily changed, if desired. The bars are made sufficiently heavy so that they will maintain the desired spacing between them without the use of tie rods and separators, thus greatly facilitating the cleaning of the screen.

No grit chamber is provided, as the sewage all comes from a separate system of sewers.

The suction well is 8 ft. wide by 22 ft. long and has a depth of 7 ft. below mean high water. A range of 4 ft. between mean high and mean low water is allowed for controlling the operation of the pumps. Below low-water level the ends and sides of the suction well are sloped inward so as to reduce deposition and dead corners to a minimum, and facilitate cleaning. Openings in the platform and floor above the suction well provide access so that the walls and bottom can be cleaned with a stream of water from a fire hose.

Automatically Controlled Pumps

The pumping station is located immediately adjacent to the suction well, one wall of which serves also as one of the substructure walls of the pumping station.

The pumping equipment to be installed at first will consist of two horizontal-shaft centrifugal pumps, each pump being direct-connected to a horizontal-shaft electric motor. Space has been provided for a third pumping unit. Each pump has a rated minimum of 750,000 gal. to a maximum of 2,500,000 gal. per 24 hours against a head of 31 ft., and is driven by a 25-hp. variable-speed alternating-current motor of the commutating brush-shifting type. Current for operating the motors, which will be 220-volt three-phase 60-cycle, will be obtained from the municipal power plant.

The specifications provide that the pump cases shall be so designed as to permit of the changing of impellers so that the capacity of each pump can be increased to 4,000,000 gal. per 24 hours, and also provide that the subbases on which the pumps and motors are mounted shall be so built as to permit of the substitution later of 35-hp. motors for the 25-hp. motors first installed.

The operation of the pumps will be regulated by a master controller that will automatically govern the

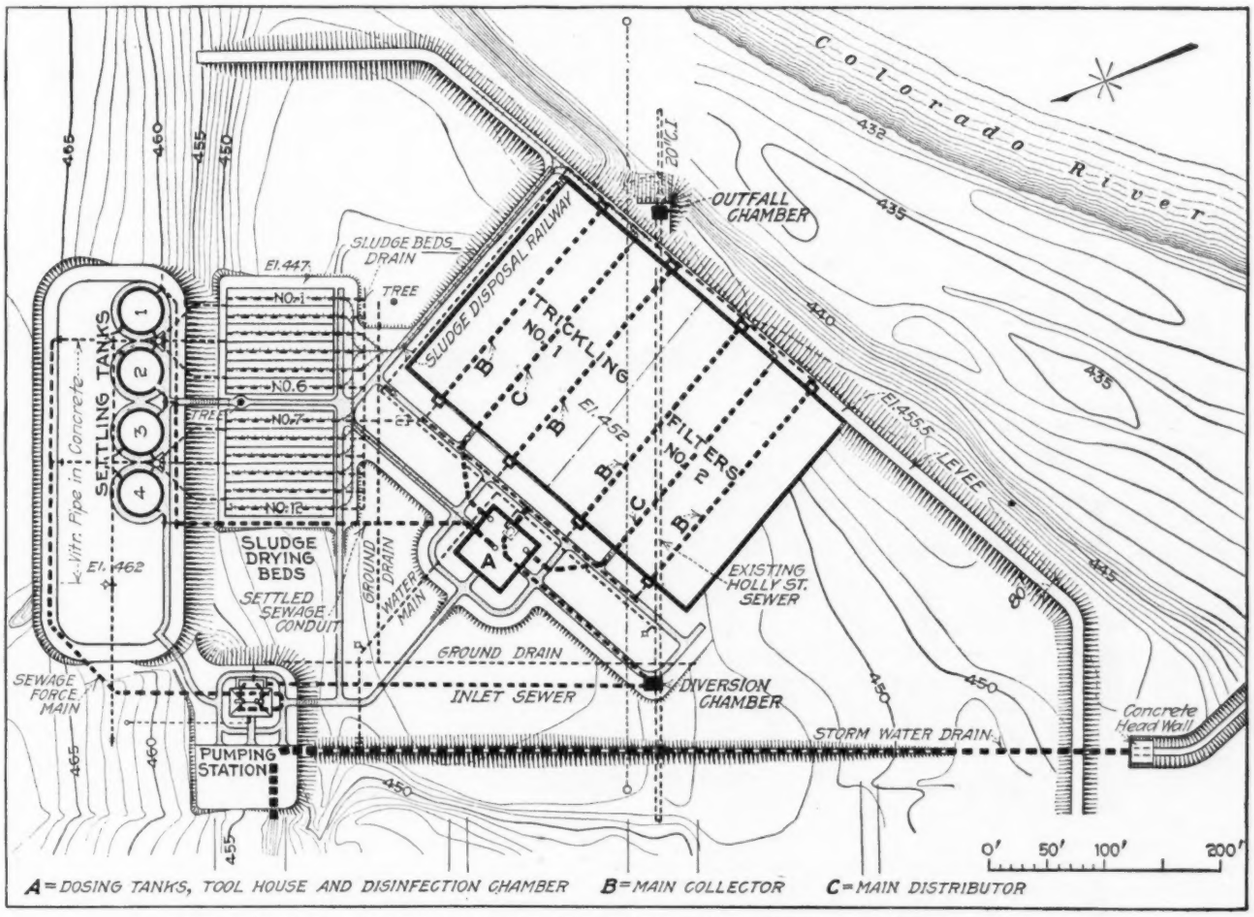
starting and stopping of either or both of the pumps, or any one or all of the three pumps after the third pump has been installed. The operation of the master controller will be governed by the level of the sewage in the suction well by means of duplicate heavy floats.

The sewage will be automatically pumped out at substantially the same rate at which it flows into the suction well. The pumping will be continuous, and without intermittent operation involving the stopping of all pumps for even short periods, thus making the rate of pumping, or outflow, as smooth and uniform as is consistent with the inflow. For this method of pump control a variation of sewage level in the suction well of 3 ft. is allowed with two pumps in service, but of 4 ft. after the third pump has been installed. Manual control of the pumps is also provided for. The pumps are self-priming with sewage at high-water level in the suction well.

The volume of sewage pumped will be measured by a 24-in. Venturi meter placed in the force main leading to the Imhoff tanks. By the use of a return loop in the force main it was possible to place the meter tube in the substructure of the pumping station and just above the switchboard gallery floor, with the indicating and recording apparatus close by. With sueh an arrangement it was possible to omit the construction of a meter vault outside the station. This arrangement also not only has the advantage of short piping connections between the meter tube and registering apparatus, but also permits of the ready inspection and cleaning of the meter-tube pressure chambers. The differential pressure from the meter tube will be transmitted to the operating parts of the register by means of compressed air. Open float tubes containing sewage, or intermediate oil seals, will not be used.

On the main floor of the station, in addition to an office and lavatory, space has been provided for a chemical and bacterial laboratory.

For the first installation four Imhoff tanks are provided, each tank (see details) being 37 ft. in diameter inside and 30 ft. deep below the water line. Although

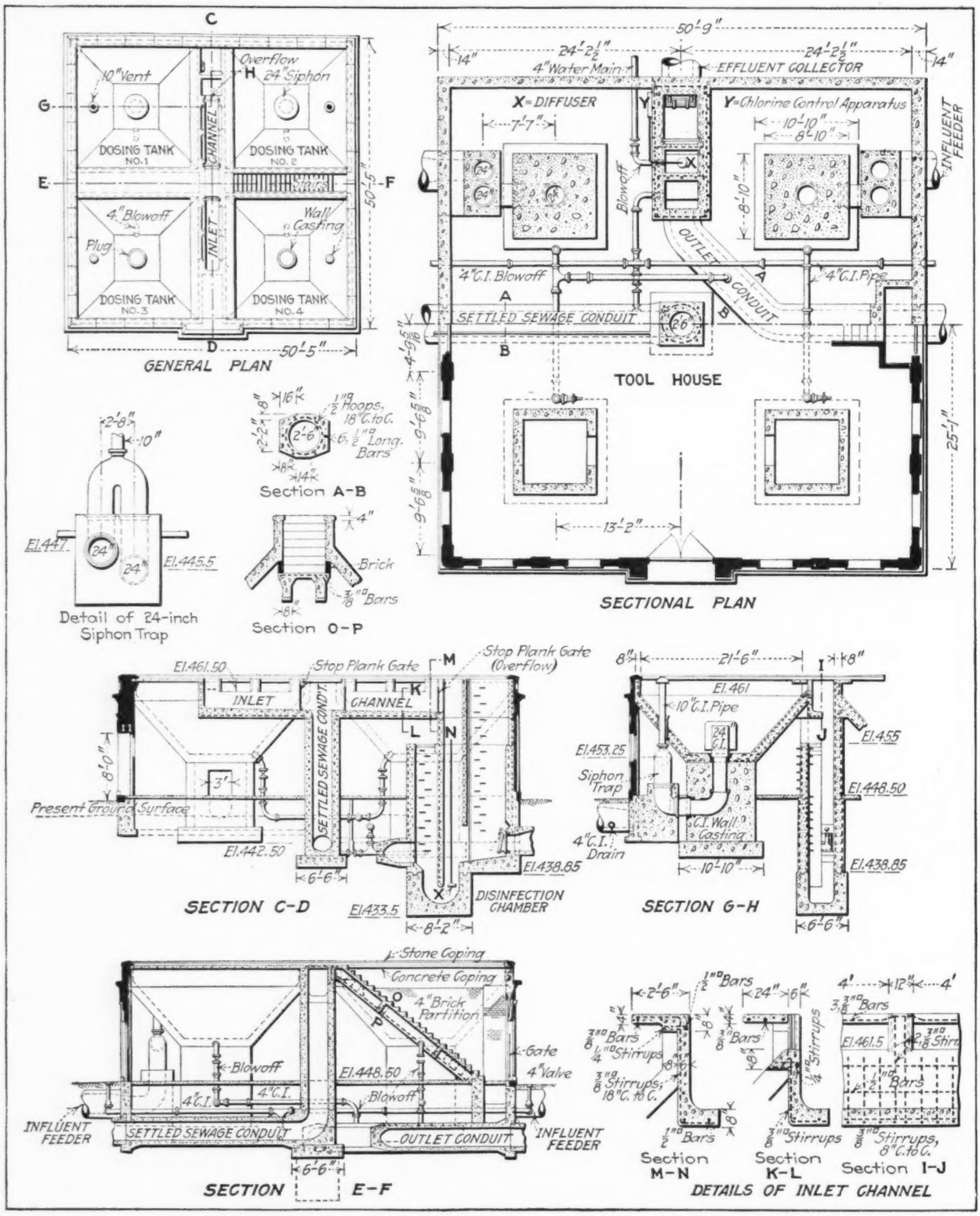


THE GENERAL ARRANGEMENT OF THE WORKS AND PIPING IS SHOWN BY THE PLAN

circular, the tanks are not of the radial-flow type. The screened sewage will be admitted over the weirs of an inlet chamber located on one side of the tank, and on the opposite side of the tank the settled sewage will pass off over the weirs of an outlet chamber.

Each tank has been so designed as to permit of the collecting of the gas escaping from the sludge chamber, for use in the pumping station if it should be found desirable to thus use it, but the installation of the hoods, piping and equipment for collecting and storing the gas will be deferred for the present.

The sludge pipes from each set of two Imhoff tanks terminate in an open sludge-discharge manhole close by, in which the sludge valves are located and where the character of the sludge withdrawn can at once be observed. The two sludge-discharge manholes also serve to control the flow of sludge to the sludge-drying beds.



FOUR DOSING CHAMBERS, A DISINFECTING CHAMBER AND TOOL HOUSE ARE COMBINED

Twelve sludge-drying beds are provided, arranged in two batteries of six each, with piping connections so that sludge from either of two Imhoff tanks can be run onto any one of six drying beds. Each bed is 15 x 93 ft. in plan and has a track of 2-ft. gage running up the center of the surface of the bed. The filter medium has an average thickness of 12 in. The walls and partitions, inclosing and separating the beds, will consist of concrete boards held in place by concrete posts.

Although only two trickling filters are to be built in the first installation, four dosing tanks, with hopper bottoms, will be constructed but dosing siphons will be placed in only two of them at present. As the topography at the site is such that the dosing tanks would

have to be built up above the surface of the ground, it was found that economy in construction and improved appearance of the works would result by building four instead of two tanks, by walling in the four tanks and by using the space under and between the tanks as a storage and tool house and disinfection chamber. Such an arrangement saved not only the construction of a separate tool house, but also that of a separate disinfection chamber and house. In addition to space for the storage of the miscellaneous tools and equipment needed for operating the works, there is sufficient room for the housing of a motor truck or automobile. In appearance the dosing tanks will resemble a large gatehouse. Access to the dosing tanks is provided by a stairway between two of the tanks and reached from the outside.

Settled sewage from the Imhoff tanks is received in an inlet channel, from which it flows over weirs into the dosing tanks. A stop-plank gate is provided at one end of the inlet channel. This gate also serves as an overflow in case too many lateral distributors in the trickling filters should be shut off by accident, thus leaving an insufficient number in service to take the sewage flow. By raising this stop-plank gate the settled sewage can be caused to flow directly into the disinfection chamber, thus bypassing entirely the dosing tanks and trickling filters, although still permitting of the disinfection of the settled sewage. Such a method of operation might be found desirable during flood stages in the river.

The disinfection chamber is located between two of the dosing tanks. The walls of the chamber are carried up above flood level in the river, and back-flooding of the trickling filters is prevented by a flap valve set on the lower end of the effluent collector running from the trickling filters to the disinfection chamber. The application of the chlorine gas to the effluent will be by manual control.

Trickling Filters

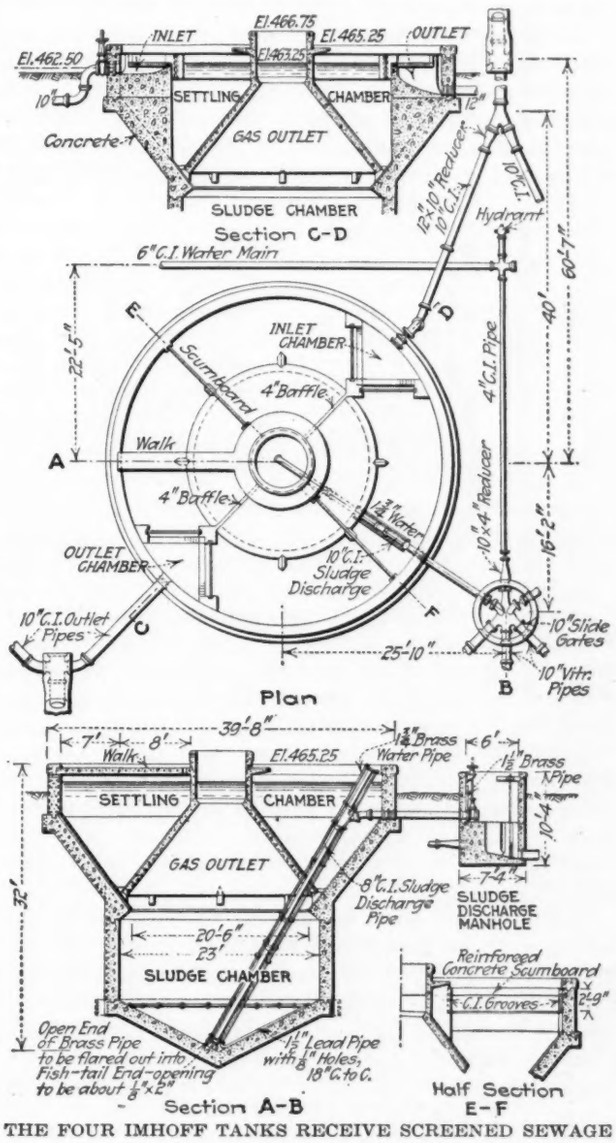
There are two trickling filters, each 157 ft. 10 in. wide by 209 ft. long on the neat lines. The floors are of concrete, 4 in. thick, with 6-in. split tile bedded in and laid thereon. Each filter is divided by the main distributor into halves, a main collector running up through the center of each half. Access to each main collector is had through a manhole at each end.

The 30-in. main distributors, one to each filter, are of 6-in. Universal cast-iron pipe, laid in and near the top of, and supported by, the filter material. Each lateral distributor is fitted with a gate valve located immediately adjacent to the riser connecting the lateral distributor with the main distributor.

For purposes of comparison under regular operating conditions the filters will be equipped with three types of nozzles. One filter will be fitted throughout with modified Columbus nozzles; each half of the other filter will be fitted with Worcester and Taylor nozzles, respectively. The nozzles will all have the same screw thread, so as to be interchangeable.

The filter material, which is from 1 to 2 in. in size, has a minimum depth of 6 ft. The filters have been so designed, however, that the depth of filter material can be increased somewhat, at a later date, a procedure which will be considerably less expensive than the increasing of the filter area, when extensions become necessary.

As with the dosing tanks, the trickling filters set up above the ground. After comparative studies and estimates, it was found that an L-shaped retaining wall of the cantilever type will best meet local conditions. Not only will it keep the volume of filter material at a minimum, a condition which is desirable under Austin conditions, but it will provide a means by which a concrete walk can be built around and at the surface of the filters, and without great expense, a feature much desired for proper operation, by simply constructing a



THE FOUR IMHOFF TANKS RECEIVE SCREENED SEWAGE

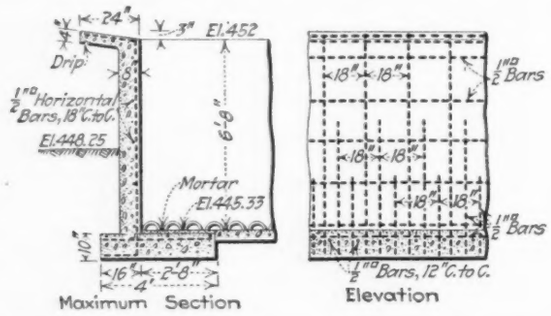
cantilever slab out from the top of the wall. Also the grading around the filters is brought to such an elevation that in walking around the filters an observer can easily see all over the surface of the filters.

Means and equipment for disinfecting the effluent from the works have been provided. As previously stated, the disinfection chamber, where chlorine gas can be applied, is located in the storage house under the dosing tanks. No retention tank for the sewage to flow through after the application of the disinfectant has been provided at present, as a sufficient period of time for contact can be obtained with the effluent flowing through the outlet conduit, the lower end of the

Holly St. sewer and the submerged outlet pipes in the river.

To insure a slow flow through the outlet conduit and Holly St. sewer, an outfall chamber is to be built at the end of the sewer, in which stop planks will be placed across a widening of the sewer. The stop planks will serve not only to make the outlet conduit and Holly St. sewer act as a retention tank but also to provide the outfall weir over which the effluent finally flows just before passing into the pipes leading to the submerged outlet.

As the works will be in full view of a proposed boulevard, every attempt has been made to make them as attractive as possible. Thus, the exterior walls of the pumping station and of the diversion chamber (which extends up above the surface of the ground, as do the dosing tanks), as well as the walls inclosing the dosing



SPRINKLING FILTER RETAINING WALLS HAVE L-SHAPED CANTILEVER SECTION

tanks, will be faced with red tapestry brick, laid in Flemish bond, with Bedford Indiana limestone trimmings. The roof of the pumping station will be covered with red Spanish tiles. Gravel walks have been laid out about the works so that, with the grading and planting contemplated, the works will have more or less the appearance of a park. A water main, with a number of connections and hydrants, provides ample facilities for flushing, cleaning and sprinkling. Sufficient land has been obtained so that the works can be more than doubled in capacity.

The sewage-disposal works will be built under the direction of the Department of Streets and Public Improvements, of which P. W. Powell is superintendent, and of M. C. Welborn, city engineer, who will be in immediate charge of the work. The plans and specifications for the works were prepared under the direction of the writer while a member of the late firm of Hering & Gregory, of New York City.

Utility Roads First Is Utah's Policy

Hard surface roads are considered by the present state administration of Utah of secondary importance to furnishing fertile back-country farming districts with possible outlets. In consequence, the highway department is bending its efforts toward supplying several such valleys with roads which are of simple construction, yet mean much to the districts tapped. For two such roads projected this summer, a 165-mile stretch from Thompson Springs to Grayling, and 55 miles from Helper to Duchesne, it is hoped to get approval to use the Federal Aid allotment.

Suggestions for Paving Parkway Drives and Boulevards

Bituminous Carpet on Concrete Base Advocated—Admixture of Mineral Dust with Bitumen Favored

By S. Whinery
Civil Engineer, New York City

While paving practice for city streets has become fairly well standardized, with a consequent accumulation of data on construction and maintenance methods, the amount of really useful information on the less heavily traveled parkway drives and boulevards is comparatively meager. Mr. Whinery's article, therefore, should appeal to a wide circle of city engineers and road officials, most of whom are responsible for a certain mileage of park routes. The bituminous carpet on concrete base is the type advocated by Mr. Whinery, who lays particular stress on two points which are held to be all-important if this form of construction is to be a success.

THE REVOLUTION that has taken place during the last three decades in the character of the travel over our park drives and boulevards has made necessary a radical change in the kind and character of pavements for this class of highways. It is admitted by all that the waterbound macadam and gravel pavements, so well suited to the earlier conditions, are inadequate where rubber-tired wheels prevail. The problem of the present is to find the best and most economical pavement to substitute for them to meet present conditions. This problem has not yet been satisfactorily solved.

What is needed is a pavement that shall be smooth, dustless, easily cleaned, not slippery, and that can be constructed and maintained at so low a cost as to be most economical. Great durability is not necessarily a controlling factor except as it may affect ultimate economy. Broadly stated, the element of economy resolves itself, other things being equal, into the question: What pavement can be constructed and maintained through a long period of years at the least cost per square yard per year? In other words, what pavement will give the largest returns in satisfactory service for each dollar invested in it?

The writer is of the opinion that these requisites will ultimately be found in what is called a bituminous-carpeted hydraulic-concrete pavement. This type of pavement is not new, but it is still in the experimental stage of development that all our standard pavements have passed through. Most of those so far built give promise of reasonable success, but there have been not a few failures. This was to be expected when we consider the differing materials used and the varying methods of construction followed. Most of the failures to secure satisfactory results, are, in the opinion of the writer, due, in some degree, to the use of inferior materials, but mostly to faulty construction.

We must constantly keep in mind that any satisfactory pavement must possess two primary requisites; it must have the supporting strength to carry the max-

imum wheel loads to which it will be subjected, and the ability to resist the surface abrasion and wear of travel. The first requisite may be met with a good concrete foundation. We now have ample knowledge and experience, if intelligently applied, to guide us in the design and construction of concrete pavement foundations and little need be said on that subject.

But in the matter of bituminous carpet-coatings we greatly need further knowledge and experience. The best material to use, its proper preparation, its consistency and the methods of its application, are all matters about which there is more or less difference of opinion and practice among engineers. It will probably be found that the best material (bitumen) for the purpose is a natural asphalt, though there is evidence that some of the coal-tar preparations will give good results. The exact composition, consistency, and treatment of the bitumen that will give the best results can not yet be stated definitely—it will vary more or less with conditions of travel and climate.

Add Mineral Dust

Our experience with sheet asphalt and other bituminous surfaces should help us here. In carpet-coating work we have apparently overlooked the very important function of colloidal matter—mineral "dust" as it is called in the asphalt paving industry—in increasing the toughness and wearing qualities of bituminous cements. The writer's first suggestion is, that the bituminous cement should be specially prepared by the intimate admixture with the melted bitumen of as much such "dust" as it will carry without impeding the spraying of the mixture on the street. Not less than 25% by weight doubtless can be and should be used—more if possible. In asphalt pavements the weight of the dust used is often almost equal to that of the asphalt cement. The consistency of the bituminous cement will vary with conditions, but we safely may say that it will be harder than the heaviest road oils and softer than the asphaltic cement for asphalt pavements.

In the methods of applying the two coatings of cement to the street, the quantity to be used, the application of screenings or gravel and the rolling, present best practice is, probably, about right—subject, of course, to further experience.

The most frequently observed and most serious source of trouble with bituminous carpet-coats on concrete roads is the failure of the coating to adhere to the concrete. The practice is almost universal of finishing the top of the concrete with a surface of rich, fine concrete or mortar alone, gaged to the proper grade and practically "troweled" so that it sets to a smooth, dense, glassy surface almost, if not quite, impervious even to water. The liquid bitumen does not penetrate or "take hold" of this surface even when perfectly dry, and if the concrete is damp the hot bitumen generates a film of vapor between the two surfaces, still further preventing proper adhesion. The result is that under travel the carpet-coat is easily displaced, breaks up, and is carried away, leaving the concrete perfectly bare.

This defect should be easily remedied. Since the resistance to abrasion is no part of the intended function of the concrete foundation, the rich, dense, glassy finish is not necessary. If ordinary good concrete is used throughout, its top surface gaged to the true grade and compressed by tamping, or what is far better in this case, rolled with a hand roller, say 30 in. long and weighing about 750 lb., such as is commonly used in the asphalt pavement industry, an ideal surface should result. It will be true, hard and strong, but not dense or glassy, and the hot bitumen will penetrate it slightly and become firmly anchored thereto. It will be noted that, recently, many engineers of experience in this line of work require that the concrete shall be thrown open to travel for some months or even years before the bituminous coating is applied. The rationelle of this practice is, obviously, to secure the roughening of the surface of the concrete so that the bituminous coating will adhere to it. Why not secure this effect at once by the treatment here suggested?

It will be noted that the construction herein suggested differs materially from approved present practice in two particulars only; the special preparation of the bituminous cement by the addition of mineral colloidal matter, and the finishing of the concrete with a somewhat rough and porous surface. Other details of some importance might be discussed, but the length of this article forbids; and they may safely be left to the intelligent engineer.

A pavement for parkways and boulevards of this type, when further experience shall enable us to perfect it, should be comparatively low in first cost and cheaply maintained. It is true that, with present prices of portland cement, no pavement with a concrete foundation can be built very cheaply, but if the carpet-coat can be made to shield the foundation effectually from wear, the latter should be practically permanent. The bituminous surface coat should be quite inexpensive and even if it should require renewal every four or five years the average cost of maintenance per yard per year should be quite low.

Illinois Has New Civil Administration

The numerous departments, commissions and bureaus which have gradually and unsystematically developed in the state government of Illinois have now been consolidated into nine departments, under a new civil administration code. This was drafted by Governor Lowden in order to concentrate authority and increase efficiency and economy. It went into effect in July. These departments and their directors are as follows: Department of Public Works and Buildings, Leslie Puterbaugh, of Peoria; Department of Health, Dr. C. St. Clair Drake, of Springfield; Department of Public Welfare, Charles Thorne, of Winnetka; Department of Mines and Minerals, Evan D. John, of Carbondale; Department of Trade and Commerce, William H. Stead, of Ottawa; Department of Labor, Barney Cohen, of Chicago; Department of Agriculture, Charles Adkins, of Bement; Department of Finance, Omar H. Wright, of Belvidere; Department of Registration and Education, Francis W. Shepherdson, of Chicago.

The former State Highway Department is now the Division of Highways in the Department of Public Works and Buildings. This division is headed by S. E. Bradt, superintendent of highways. The death of W. W. Marr, chief highway engineer, is noted elsewhere in this issue.

Four-Slip Shipyard Compactly Arranged on City Property

Labor Conditions Made City Location Desirable and Yard Was Accordingly Laid Out for Maximum Economy of Space

THE Supple-Ballin Shipyards at Portland, Ore., were located on the Willamette River within the city limits in preference to sites where more space was available but which were some distance away, because it was believed that the problem of keeping an adequate force of men at work would be less near trade and residence centers. It then became an important problem to develop the most economical layout of the yard and its equipment so that the maximum use could be made of a limited amount of this higher priced frontage. The plant covers about 7½ acres.

The accompanying plan shows the general arrangement of four slips which are so spaced that a gantry crane can pass between each pair and by means of an 80-ft. boom, deliver material to any point on the slips. By beginning and keeping the work on each slip a little in advance of that on the next slip it is possible to make the most efficient and economical use of the several crews which are trained for speed in certain specialties.

The lumber yard, 200 x 200 ft. in plan, could not be located on river frontage and is separated from the main portion of the yard by a 60-ft. street. However, a railroad siding serves the yard, and a gantry crane is used to handle the lumber. This crane has a 100-ft. span and extends the full length of the yard so it can deliver and pile lumber at any point. This crane takes the lumber from the cars and stacks it near the saws. After going through the saws it is taken by motor truck across the street and to the desired point in the main yard.

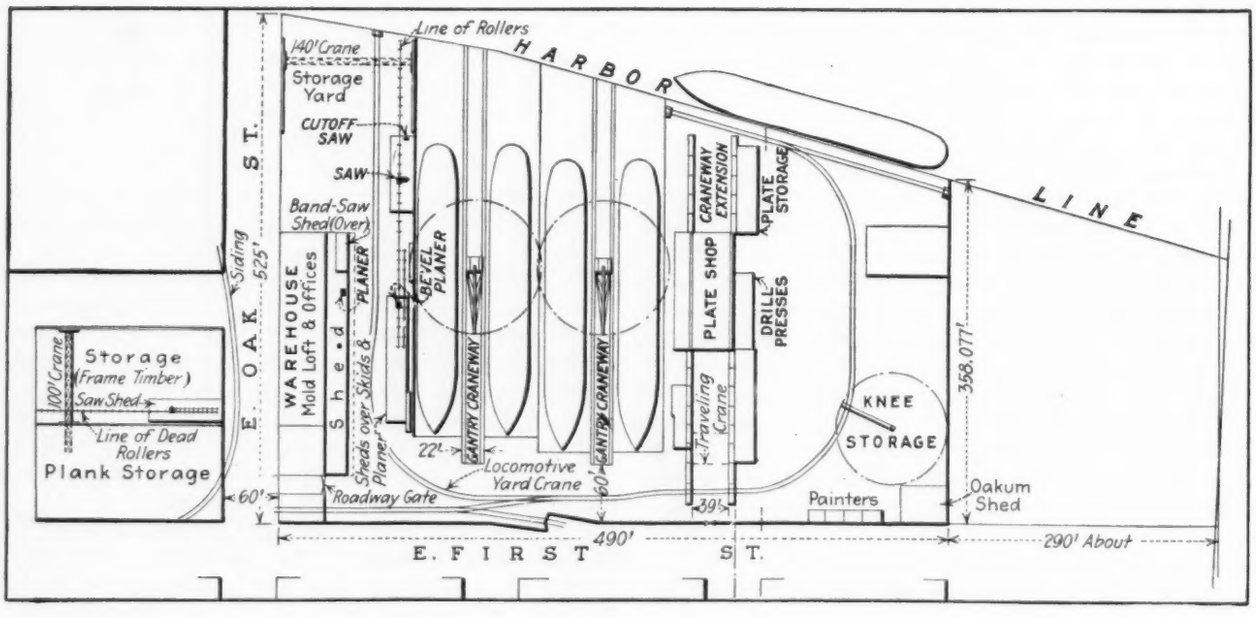
The main yard has its own railroad siding and it is notable that freight can be taken directly from the railroad cars by the electric traveling crane in the plate shop, by the gantries operating between boats or by a locomotive crane which travels along the industrial track to all parts of the work. The locomotive crane and gantries can also unload from a barge at the dock and deliver thence direct to gantry or plate shop crane. The woodworking machinery, for the most part, is placed in the main yard at points where the several operations required can be done as the material moves along toward its destination, thus minimizing rehandling.

In addition to the time saving in handling material it is notable that the use of gantry, traveling and locomotive cranes keeps the yard free of cars or trains en route to various parts of the work or waiting to be unloaded. The gantries used between slips were built specially for the service and are operated on a turntable 24 ft. above the rail. The motive power is a 30-hp. 220-volt motor. The boom has a capacity of 2½ tons at the end or 5 tons at the 40 ft. point.

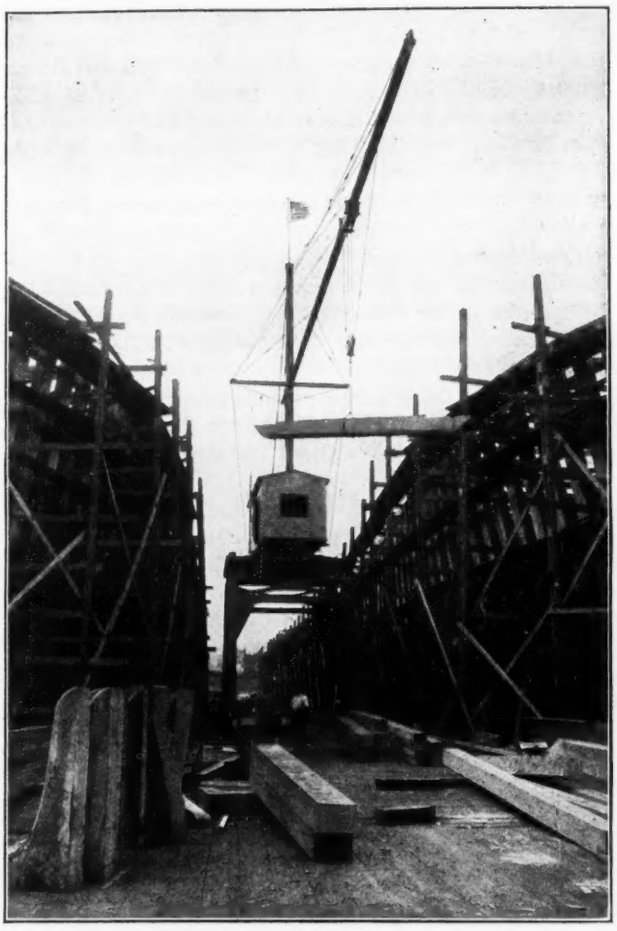
One of the chief functions of these cranes is to deliver heavy timbers to the frame-assembling platform where the frames are built up. When they are ready the gantry is used to lift them upright and put them in place in the hull. The booms swing entirely across each vessel.

The locomotive crane, which burns wood, has a 50-ft. boom with a capacity of 15 tons, and is geared so as to give a speed of about 10 miles per hour. Because of its ability to quickly pick up material and deliver it speedily to any part of the work it is an important factor in the rapid rate of construction demanded at these yards. The plate shop crane has a 31-ft. span and a capacity of 5 tons.

About a half mile up the river the company is now building a plant which will be able to manufacture boilers and engines complete for the vessels built in the



ECONOMICAL LAYOUT OF YARD AND EQUIPMENT WERE IMPORTANT BECAUSE OF THE HIGH PRICE OF THE WATERFRONT PROPERTY OCCUPIED WITHIN THE CITY LIMITS



GANTRY BETWEEN WAYS IN PORTLAND SHIPYARD

yard just described. Here the boilers will be built, cylinders will be cast, and an up-to-date machine shop will turn out all parts and accessories. The equipment includes an 84-in. lathe with a 40-ft. bed, a 30-in. slotter, and a large open side wall planer weighing 50 tons.

The frontage owned is such that by making vessels fast two abreast, four 300-ft. boats can lie alongside the main yard and two alongside the engine building plant.

Oxyacetylene Welding for Track Repairs

Repairing of frogs and track crossings by building up the worn places by oxyacetylene welding is being practised in side-track repair work on the Chicago & Northwestern Ry. The work is done by the section gangs, and the success has been such that it is intended to provide an outfit for each roadmaster's division. The same outfits are used for cutting rails, boring bolt holes and welding pieces of angle-bar under the rail base to serve as anchors. Particulars of the work were given at the recent annual meeting of the Roadmasters' and Maintenance of Way Association by P. J. McAndrews, roadmaster of the Chicago & North Western at Sterling, Ill. The welding and cutting have been confined to side-track work as yet, but Mr. McAndrews considers that with proper care the process can be employed in main-track repair work.

May Higher Shear Values Be Used in Concrete Design?

Low Figures Now Accepted Based on Tests of Beams Which Did Not Fail Primarily in Shear —Higher Tests Cited

By W. P. Anderson
President, Ferro Concrete Construction Co., Cincinnati

THERE is a tendency among some engineers to use unnecessarily low unit stresses in reinforced-concrete construction, causing an uneconomical design. In beam-and-girder construction, particularly, the total allowable unit shear value may materially affect the cost. Within certain limits, the extra steel required in a beam with a high unit shear stress does not entirely offset the saving in concrete, and the net saving may run 8% of the total cost of the beam. The use of a high total shear value also gives greater flexibility in design. In buildings with varying floor or roof loads, corresponding beams can be kept the same size by using higher shear values with higher floor loads, and although the saving in the beam with the high shear value may not be great itself, there will be a great saving where the formwork can be reused without remaking. Considerations other than shear may determine the width of a beam, such as the spacing of the bars or the compression at the support, but that is no reason for adopting unnecessarily low shear values.

Improper Design of Test Pieces

The generally low unit shear values used and proposed by various specifications are a result of tests in which low maximum shears have been obtained. It is the opinion of the writer that such low values are due to the improper design of the test pieces, which have not failed in shear but through lack of sufficent compression or tension area, proper broading of the member at the support, insufficient bond or a combination of these things.

The writer has knowledge of at least three series of tests which were designed so as to insure initial failure in shear, and in each of these the unit values obtained were high.

In 1907 the Ferro Concrete Construction Co. made some tests under the writer's direction in which shear values as high as 1032 lb. per sq.in. were obtained. In these tests a narrow web was used with an excessive amount of tensional steel and of concrete in compression, and the tensional steel had ample grip in broad supports. In 1915 a series of tests was made at the University of Cincinnati, where shear values as high as 1340 lb. per sq.in. were obtained. An account of these tests appeared in the April, 1917, issue of *Concrete*.

The tests made by the Ferro Concrete Co. showed that very fine hair cracks due to shear develop with total unit shear values of from 200 to 300 lb. per sq.in. In the tests at the University of Cincinnati, the first diagonal shear cracks appeared after the vertical cracks due to direct tension, and at total unit shear values in numerous cases as high as 370 lb. per sq.in. In the beams carrying high shear values, the first shear cracks were very fine hair cracks, which would ordinarily go unnoticed.

These results are confirmed by a series of tests made by R. Saliger of the Technische Hochschule, of Vienna, and published in *Zeitschrift für Betonbau*, Nos. 8 and 9, 1913, and No. 1, 1914. The test pieces are shown in the accompanying drawing. In all the beams 12 round rods 13 mm. in diameter were arranged in four layers of three rods each, but the number bent up to the flnages was three in beams 23 and 24, six in beams 25 and 26, and nine in beams 27 and 28. None was bent up in beams 21 and 22. The omission of stirrups was intentional, in order not to obscure the results by their influence. Half of the beams were of reduced stem width as shown. In order to keep the moment resistance high, high-carbon steel was used.

The carrying capacity of the beams with wide stem was, in all cases, greater than with narrow stem, and the inclined reinforcement in all cases increased the carrying capacity.

Professor Saliger gives the following formula where the initial failure is in the inclined reinforcement:

$$V = V_c + V_s = bdv - (d/x)A_b \sqrt{2}\, f_{es}$$

where V = total ultimate shear value; V_s, steel shear; V_c, concrete shear; b, width of beam; d, effective depth; v, shear unit stress in concrete; x, distance from support to application of load; A_b, area of bent-up steel, and f_{es}, elastic limit of steel.

This formula combines the truss action of the reinforcement with the shearing value of the plain beam. The stem of the beam must, however, be wide enough to take the compression within it caused by the truss action.

Professor Saliger's Conclusions

1. The carrying capacity of beams is limited by the resistance of the tensional area. This resistance does not amount to much more than the elastic limit of the steel (at a maximum about 8% more) if figured in reference to the center of gravity of the reinforcement. Therefore it is the elastic limit and not the ultimate strength that determines the capacity. On this account steel of a higher elastic limit may be used to advantage.

2. Beams that have not inclined reinforcement attain their highest load when subjected to an average shearing strain of 426 lb. per sq.in.

3. In beams that have their inclined reinforcement correctly arranged the causes of failure were found to be (a) in the exceeding of the elastic limit of the inclined steel, or (b) in the crushing of the concrete (in the web) if the compression exceeds the compressive strength of the concrete. This is the case when the calculated shearing force exceeds 1065 to 1280 lb. per sq.in.

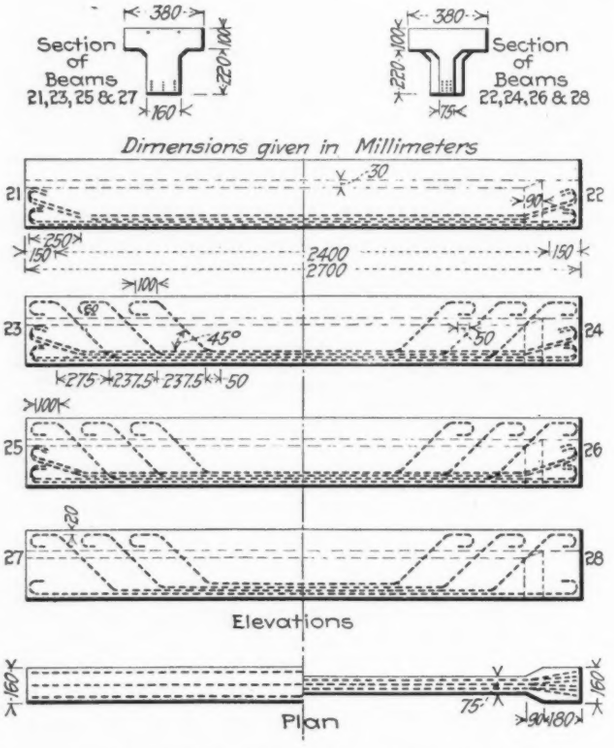
4. In case (a) the total shearing resistance is naturally the sum of the resistance of a beam that has no inclined reinforcement and the resistance furnished by the inclined reinforcement due to truss action. With a 1:4 concrete and an allowable value of 71 lb. per sq.in. for the shear value of the concrete and from 14,200 to 17,300 lb. per sq.in. on the steel, 298 lb. per sq.in. can be taken as the total unit shear value with a factor of safety of 3½.

5. In case (b), with the gradual elimination of the concrete shear resistance, the total shear resistance consists of that furnished by the inclined reinforcement only. With allowable stresses on the steel of from 14,200 to 17,300 lb. per sq.in. a shearing value of 355 lb. per sq.in. will give a factor of safety of 3½.

6. The highest shearing strength obtained by the investigation amounts to a calculated stress of 1270 lb. per sq.in. in beams without stirrups, which would equal an allowable working stress of 355 lb. per sq.in. with a factor of safety of 3½.

Professor Saliger also states in this article that 213 lb. per sq.in. is the shear value allowed in the Austrian regulations of June, 1911, and that these appear much too low.

The writer wishes to call attention to the high value of 426 lb. per sq.in. which Professor Saliger gives in conclusion 2 for beams without inclined reinforcement.



BEAMS TESTED SHOW HIGH SHEAR VALUES

This result is due to the firm anchorage of the straight bars, whch causes an arching action in the beam.

As a result of these three tests the writer concludes that a total unit shear value of 180 lb. per sq.in. for beams in the interior of buildings will be found economical, and, where desired, a stress as high as 240 lb. per sq.in. for uniformly loaded beams can be used to advantage. He would recommend a somewhat lower stress for girders carrying concentrated loads, because in uniform loading the high shear value is confined to a short distance near the support, which is not the case with concentrated loading. With proper design shear cracks will not appear at these values, and should they occur inside a building, they will not be noticed. For outside or under-water work, where moisture may get to the steel and cause rusting, lower values will probably be safer.

ENGINEERING LITERATURE

A REVIEW OF BOOKS AND A LISTING OF NEW PUBLICATIONS

Pioneer Book on an Important Subject

EXCESS CONDEMNATION: By Robert Eugene Cushman, Instructor in Political Science, University of Illinois. New York and London: D. Appleton & Co. Leather; 5 x 8 in.; pp. 323. $2.

Engineers who plan improvements which involve taking private land for public purposes should welcome this volume. In fact, it deserves double welcome: First, because it is a pioneer book and second because it presents ample data on the many perplexing phases of the subject and discusses in a judicial spirit the evidence on both sides of controverted questions.

Although practiced under various names for nearly a hundred years abroad, excess condemnation is a relatively new term in this country and has been more written of than practiced. Even in Europe it has passed beyond the experimental stage only in Great Britain, France and Germany. Its growing importance is largely due to the aid it promises to give to city planning, using that term to cover both minor and major improvements.

Mr. Cushman defines excess condemnation as "the policy, on the part of the state or city, of taking by right of eminent domain more property than is actually necessary for the creation of a public improvement, and of subsequently selling or leasing this surplus." The three main objects of excess condemnation are (1) to solve the vexing problems of remnants of land, which the city almost inevitably has to pay for but which ordinarily remain in private ownership, unused and unkempt or used in a way detrimental to other property and to the city as a whole; (2) for the protection of improvements against the prejudicial use of adjacent land; (3) to take for the benefit of the city the increase in values of land adjacent to public improvements, due to the improvements themselves, and thus pay or help pay for the cost of the improvements.

After a brief introductory chapter the author discusses at length each of the three objects of excess condemnation just noted. He then takes up "gains and risks" administration, and the constitutionality of excess condemnation. A few bibliographical references and a list of cases cited are given.

The judicial spirit shown by the author throughout adds greatly to the value of a book dealing, as does this one, with a subject relatively new to this country, promising much, but still involved in legal and financial uncertainties. The legal uncertainties are probably all subject to removal by constitutional amendments. The financial doubts can best be resolved by actual tests. Of the three objects of excess condemnation noted, the author seems to have least doubts as to the desired ends being attained as regards handling remnants and protection of improvements. Profit making standing by itself is in more doubt, both as to results and constitutionality. Moreover, making abutting benefited property meet at least a part of the cost of many municipal improvements has long been practiced in this country through special assessments for benefits.

The book deserves the careful attention of engineers and other city officials concerned in planning, financing and protecting municipal improvements, broad- minded real estate men and all who are interested in helping on the orderly and economical growth of municipal improvements, including taxpayers who have their own and their city's interests at heart.

Street Problems and Details

PRACTICAL STREET CONSTRUCTION—Planning Streets and Designing and Constructing the Details of Street Surface, Subsurface and Supersurface Structures.—New York: Municipal Journal and Engineer. Reprinted from a series of articles that appeared in "Municipal Journal." 1916. Cloth; 6 x 9 in.; pp. viii + 248; 151 illustrations. $2.

That part of city planning which relates to the alignment, construction and use of city streets is the subject of this volume. It is a collection of articles which already have been published serially in the "Municipal Journal."

It is the professed aim of the authors to make the book of practical value to the city engineer in connection with his professional work, and in this purpose there is every reason to believe they have succeeded. They have gathered together a wealth of practical information on the alignment, widths, uses and treatment of city highways, combining in one volume a great deal of information which would otherwise have been widely scattered in periodical literature.

Pavement work is purposely left out, as it is recognized this subject is adequately covered in many textbooks; but the discussion covers street alignment, grade and cross-section; the location of sewers and other underground structures, of fire-alarm boxes, shade trees, street signs, and the other internal and external factors which enter into the construction, maintenance and operation of city streets.

The text is well illustrated with both half-tones and line-cuts showing either good or "horrible" examples of the points brought up. The illustrations include many details in the solution of grade, drainage and traffic problems which will be found very helpful to city engineers facing similar conditions.

The two chapters on street and sidewalk widths by H. C. Hutchins will be found of particular interest, as they contain data of an unusual kind, which are of practical utility not only in the design of new streets but also for the drawing of intelligent traffic rules and regulations. This is a matter which deservedly is receiving more and more attention by municipal engineers, and is more within their province than in that of city police departments.

While the text contains no matter on pavement construction, it does contain, as the above account will show, a variety of material which can and should be used in the selection of pavement types. Although the proper surfacing of a street is very likely the most important

phase in street construction, it is a problem which cannot be intelligently attacked unless there is a thorough understanding of a great variety of minor details not ordinarily treated in books on pavement construction. It is the aim of the book before us to supply these details.

Railroad Handbook and Textbook

Reviewed by M. P. PARET

Lake Charles, La.; Late Valuation Engineer, Interstate Commerce Commission

RAILROAD CONSTRUCTION THEORY AND PRACTICE: A Text-Book for the Use of Students in Colleges and Technical Schools, and a Handbook for the Use of Engineers in Field and Office—By Walter Loring Webb, C. E., M. Am. Soc. C. E. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Limited. Leather; 4 x 7 in.; pp. 831; illustrated. $4.

As three earlier editions of this book have already been noticed in these columns (*Engineering News*, July 5, 1900, April 16, 1903, and Dec. 7, 1908) and as the reviewer finds little to blame and much to praise in the present edition, he will merely raise a few questions regarding the scope of the work and then pass on to some general comments.

The chapter on rolling stock seems too detailed for the field man and also for the student, unless the latter is studying to be a mechanical engineer.

Would not some chapters on electric railway construction naturally be expected in a book bearing the title of this one? Why does not the chapter on rails tell something of rail failures and their cost? Why does the author steer entirely clear of so important a railroad construction subject as steel bridges?

The reviewer hopes that Mr. Webb or some other writer on railroad construction will suggest to students and field men the educational value of knowledge of the practical methods used by successful contractors; of doing work at low cost and in short time; and of handling men and materials to advantage. The reviewer also hopes that Mr. Webb or some one else will tell a young man what it is that he can learn best by service with a railroad contractor, and also with a railroad company in the way of maintenance and train service, all to the end that he may gain wisdom for supervising railroad construction.

Not infrequently a field engineer on railroad construction has to grade, lay track, build minor bridges and buildings and operate trains. If such matters were made a part of the early education of the railroad engineer he would be prepared sooner and better to supervise work and to inform his superiors whether or not a piece of work under his charge was being done at an excessive cost, and why.

A Valuable Compendium on Wood

MECHANICAL PROPERTIES OF WOODS GROWN IN THE UNITED STATES: By J. A. Newlin, in Charge of Timber Tests, and Thomas R. C. Wilson, Engineer in Forest Products. Washington: Department of Agriculture. Paper; 6 x 9 in.; pp. 47; illustrated.

All of the data available in the United States Forest Service on the mechanical properties of wood grown in this country are presented in tables in this bulletin. This is information of particular timeliness and value.

The possible use of the data is well set forth in the prefatory paragraph of the book. As therein stated, the bulletin makes available for general use data which will serve as a basis for the comparison of species, the choice of species for particular uses, and the establishment of correct working stresses. A number of the standard species of wood are now becoming scarce. The properties of these woods are quite well known, but it is doubtful if those who will now have to find substitutes for them can readily match those properties in some other equally available but less widely known timber.

The data given in the bulletin should be of great assistance in this respect. For example, suppose it was desired to find the wood for flooring to be used in the place of maple; for flooring, hardness is the ruling factor, provided the wood possesses other strength properties to a reasonable degree. Using hardness as a basis for comparison, white oak should be as good, or better, than maple for flooring, which is true. Using modulus of rupture, which is a very important strength value in structural material, but of very little importance in flooring as a basis for comparison, long-leaf pine or Douglas fir would unjustly be given preference to both oak and maple.

The data are based upon about 130,000 tests, probably the greatest number ever made in one series upon any material and 126 species of wood have been tested. An effort has been made to cover every usable property. As the authors state, there are few uses of timber to which at least some of the properties given in the table are not of importance.

Another Landscape Gardening Classic

HINTS ON LANDSCAPE GARDENING—By Prince von Pückler-Muskau. Translated by Bernhard Sickert and Edited by Samuel Parsons. [In coöperation with the American Society of Landscape Architects.] Boston and New York: Houghton Mifflin Co. Boards, with cloth back; 6 x 9 in.; pp. 196; 44 plates and two folding maps in pocket. $3.50 net.

In coöperation with the American Society of Landscape Architects the publishers have now added a second volume to a proposed series of the writings of the masters of landscape gardening. Like the first of the series (Humphry Repton's "The Art of Landscape Gardening," noted in *Engineering News*, Jan. 16, 1908, page 81) the present volume is presented in most attractive form.

Prince Pücker, who was born in 1785 and died in 1871, was heir to a large estate in Silesia upon the improvement of which he spent vast sums through many years in accordance with carefully formulated plans based on extensive study, including the best landscape gardening in England.

After an appreciative introduction by Samuel Parsons, himself a well-known landscape gardener and writer, the book consists of two parts: Prince Pücker's "Hints on Landscape Gardening in General" and his "Description of the Park in Muskau and Its Origin." The work is an epitome of the art of landscape gardening with particular reference to large estates, followed by an example of the practice of the art by the author on his ancestral acres. Neither of these sections is long. Each is entertaining and instructive, with much of human and personal interest.

The book is unique. It is to be hoped that the series will be continued—and that without so long an interval as has passed between the appearance of the first two volumes, for art is long and time is fleeting.

Final Report on Depreciation

The final report of the American Water-Works Association Committee on Depreciation has been published as a 38-page supplement to the September *Journal* of the association. Written discussions for presentation at next year's convention may be sent to J. M. Diven, secretary, 47 State St., Troy, N. Y. John W. Alvord, Chicago, was chairman of the committee. The other members were Prof. D. W. Mead, Madison, Wis.; C. B. Salmon, Beloit, Wis.; W. F. Wilcox, Ensley, Ala.; and J. N. Hazlehurst, Atlanta, Ga. The last named dissented from the majority opinion in the portion of the report dealing with "Loss Due to Age and Straight-Line Depreciation." Appendices to the main report include some definitions of terms used in the report and also the general conclusions of the committee as to the life of various elements of a water-works system.

"Cleveland Engineering" Appears

As a further evidence of enterprise and service the Cleveland Engineering Society began the publication of a weekly bulletin on Sept. 4. Of its four pages one is devoted to current periodical literature. The Bulletin Committee of four members is headed by J. A. Moffett, and is assisted by J. W. Macklin, Chamber of Commerce Building, Cleveland, Ohio.

PUBLICATIONS RECEIVED

ASPHALT, RELATED BITUMENS, AND BITUMINOUS ROCK IN 1916—By John D. Northrop. Washington: Department of the Interior. Paper; 6 x 9 in.; pp. 281.

A MUNICIPAL EXPERIMENT, OR THE HALL OF RECORDS POWER PLANT—By Reginald Pelham Bolton. New York: The Bureau of Public Service Economics, Inc., 55 Liberty St. Cloth; 5 x 8 in.; pp. 221; illustrated. $1; $1.10 postpaid.

A PLAN OF ORGANIZATION FOR NEW YORK CITY—A Mayor, as Chief Public Representative and Framer of Policies; Relieved of Detailed Administrative Responsibility; A Board of Directors and, as a Corollary of These Changes; A City Manager. Suggestions for Charter Changes by Henry Bruère, Former Chamberlain, City of New York. [Municipal Reference Library, 512 Municipal Building, New York City.] Paper; 7 x 10 in.; pp. 44; illustrated.

BUSINESS LAW FOR ENGINEERS—By C. Frank Allen, M. Am. Soc. C. E. Part 1. Elements of Law for Engineers. Part 2. Contract Letting. New York: McGraw-Hill Book Co., Inc. London: Hill Publishing Co., Ltd. Cloth; 6 x 9 in.; pp. 494; $3.

CORPORATE ORGANIZATION AND MANAGEMENT—By Thomas Conyngton, of the New York Bar. Revised by H. Potter, of the New York Bar. New York: Ronald Press Co. Cloth; 6 x 9 in.; pp. 778; $5 postpaid.

A combination of the author's two books, "Corporate Management" published in 1903, and "Corporate Organization," published in 1904. The book seems to fulfill the author's purpose, "to furnish a compact, practical and conveniently arranged manual of corporation law and procedure."

COST OF HEALTH SUPERVISION IN INDUSTRY—Compiled for the Conference Board of Physicians in Industrial Practice—By Magnus W. Alexander. West Lynn, Mass.: The Author. Paper, 6 x 9 in.; pp. 6.

NEW JERSEY DEPARTMENT OF HEALTH: Annual Report, 1916. Trenton, N. J.: The Department. Cloth; 6 x 9 in.; pp. 335; illustrated.

Contains considerable information regarding the water-works and the water- and sewage-treatment plants of the state.

EMPIRICAL FORMULAS—By Theodore R. Running, Associate Professor of Mathematics, University of Michigan. Mathematical Monographs No. 19. Edited by Mansfield Merriman and Robert S. Woodward. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Limited. Cloth; 6 x 9 in.; pp. 143; illustrated; $1.40.

EXAMINATION OF WATER, CHEMICAL AND BACTERIOLOGICAL—By William P. Mason, Professor of Chemistry, Rensselaer Polytechnic Institute. Fifth Edition. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Limited. Cloth; 5 x 8 in.; pp. 186; illustrated. $1.25.

The author states that in his present revision of this well-known works, first issued in 1899, he made an effort to harmonize the analytical methods described with the 1917 "Standard Methods" of the American Public Health Association.

GRAPHICS—By H. W. Spangler. New York: John Wiley & Sons, Inc. London, Chapman & Hall, Limited. Cloth; 6 x 9 in.; pp. 95; illustrated; $1.25.

INGENIERIA DE FERROCARRILES: La Teoria y Practica Fundemental De Ferrocarriles, Desde la Concepcion Del Idea Hasta la Terminacion Del Trazo—By Verne Leroy Havens, M. Am. Soc. C. E. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Limited. Leather; 4 x 7 in.; pp. 357; illustrated. $3.50.

A handbook in Spanish, fashioned after the American railroad handbooks. The tables are less elaborate, however, the logarithms being carried to five places only, while the text seems to cover ground, such as the economics of railway location, not ordinarily covered in the American books—thus meeting the shortage of supplementary reference books in the Spanish language.

LIABILITY AND COMPENSATION INSURANCE: Industrial Accidents and Their Prevention, Employers' Liability, Workmen's Compensation, Insurance of Employers' Liability and Workmen's Compensation—By Ralph H. Blanchard, Instructor in Insurance, Wharton School of Finance and Commerce, University of Pennsylvania. New York and London: D. Appleton & Co. Cloth; 5 x 8 in.; pp. 394; $2.

MAINE PUBLIC UTILITIES COMMISSION: Report on Topography, Geology and Water Resources Department for 1915-1916. Augusta, Maine: The Commission. Cloth; 6 x 9 in.; pp. 228; illustrated.

MONOGRAPHS AND REPORTS ON MUNICIPAL PROBLEMS: Some Recent Reports of Exceptional Interest Published by the City of New York—New York: Municipal Reference Library, 512 Municipal Building. Paper; 6 x 9 in.; pp. 8.

NATIONAL SEPTIC PROCESS PROTECTIVE LEAGUE: Report of Special Conference, Chicago, Aug. 14, 1917—Paper; 6 x 9 in.; pp. 15. Address: Frank G. Pierce, Secretary, Marshalltown, Iowa.

NEW JERSEY PUBLIC UTILITY STATISTICS, 1915—Trenton, N. J.: The Commission. Cloth; 6 x 9 in.; pp. 222.

NEW YORK STATE WORKMEN'S COMPENSATION LAW: With Amendments, Additions and Annotations to July 1, 1917—Albany, New York: Bureau of Statistics and Information. Paper; 5 x 8 in.; pp. 79.

PROCEEDINGS OF THE FIRST INDUSTRIAL SAFETY CONGRESS OF NEW YORK STATE: Held Under the Auspices of the State Industrial Commission—Albany, New York: The Commission. Paper; 6 x 9 in.; pp. 235.

NEW YORK PUBLIC SERVICE COMMISSION, SECOND DISTRICT: Report for 1916. Albany, N. Y.: The Commission. Cloth; 6 x 9 in.; pp. 1035.

STREET RAILWAY EMPLOYMENT IN THE UNITED STATES—Washington, D. C.: Bureau of Labor Statistics. Paper; 6 x 9 in.; pp. 1131. 75c. from Superintendent of Documents, Washington, D. C.

Exhaustive data, mostly tabular, on wages, hours of labor, runs, or day's works, conditions of employment, accident, sickness and death benefits, associations of employers and employees, and agreements between employers and employees.

STREET RAILWAY FARES: Their Relation to Length of Haul and Cost of Service: Report of Investigation Carried on in the Research Division of the Electrical Engineering Department of the Massachusetts Institute of Technology—By Dugald C. Jackson, Professor of Electrical Engineering and David J. McGrath, Research Assistant in Electrical Engineering at the Massachusetts Institute of Technology. New York: McGraw-Hill Book Co., Inc. London: Hill Publishing Co., Ltd. Cloth; 6 x 9 in.; pp. 169; illustrated. $2.50.

THE COMPOSITION OF TECHNICAL PAPERS—By Homer Andrew Watt, Assistant Professor of English, New York University. New York: McGraw-Hill Book Co., Inc. London: Hill Publishing Co., Ltd. Cloth; 5 x 8 in.; pp. 431; $1.50.

THE EFFECT OF MOUTHPIECES ON THE FLOW OF WATER THROUGH A SUBMERGED SHORT PIPE—By Fred B. Seely, Associate in Theoretical and Applied Mechanics. Bulletin No. 96, Engineering Experiment Station, University of Illinois, Urbana, Ill. Paper; 6 x 9 in.; pp. 53. 25c.

THE ESSENTIALS OF DESCRIPTIVE GEOMETRY—By F. G. Higbee, M. E., Professor and Head of Department of Descriptive Geometry and Drawing, the State University of Iowa. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Limited. Cloth; 6 x 9 in.; pp. 218; illustrated; $1.80.

The present edition follows the lines of the first (see "Engineering News," Sept. 16, 1915, but portions have been rewritten and a chapter on tangencies has been added.

THE JOURNAL OF THE IRON AND STEEL INSTITUTE—Edited by George C. Lloyd, Secretary. New York: Spon & Chamberlain. London: The Institute. Cloth; 6 x 9 in.; pp. 472; illustrated.

THE PINE TREES OF THE ROCKY MOUNTAIN REGION—By George B. Sudworth, Dendrologist. Washington, D. C.: U. S. Department of Agriculture. Paper; 6 x 9 in.; pp. 46, illustrated.

THE PRINCIPLES OF IRON FOUNDING—By Richard Moldenke, E. M., Ph. D. New York: McGraw-Hill Book Co., Inc. London: Hill Publishing Co., Ltd. Cloth; 6 x 9 in.; pp. 517. $4.

WATT AND THE STEAM AGE: A Concise History of the Art of Steam Navigation, Mechanical and Marine Engineering. Paddle and Screw Steamers; Reciprocating Engines, Steam Turbines and Electricity—By John W. Grant, C. E. London: St. Bride's Press, Ltd. Cloth; 5 x 8 in.; pp. 212; illustrated.

LETTERS TO THE EDITOR

Comment on Matters of Interest to Engineers and Contractors Will Be Welcome

Highway Relief for Railroad Congestion

Sir—I have just re-read the editorial which appears in your issue of Sept. 27, p. 578, and believe it to be a splendid exposition of the real function of our highway system. As supplementing the work of the railroads and acting under certain conditions in conjunction with and as auxiliary thereto, the necessity of considering motor transportation resources and the highways over which they will be required to travel besomes increasingly important. Apart from the primal necessity of actually moving products England has found necessary the functioning of motor transportation, as described above, in order to meet increasing traffic demands with a diminishing supply of fuel and men.

I sincerely trust that your editorial may be read by those men who are giving most of their thought to problems which bear on our winning this war, and that they will appreciate that, aside from the fact that the system of roads is needed for our common defense, at the same time they are adding something of permanent and increasing value to the country.

A. C. HARGREAVES,
Chairman, Storage Committee, War Industries Board,
Council of National Defense.
Washington, D. C.

Safe Filter Operation Requires Skilled Attention

Sir—In a Western filter plant recently visited the influent water was pouring over the gutters upon a bare sand surface and seeping away too fast to maintain a head on the filter. The attendant was busily engaged in "making up" a new batch of chemical solution. He explained that the filters were operating faster than the supply could be got to them, and, "anyway, the chemical did all the work." Indecision on the writer's part as to whether or not to take a mud bath in the fluid flowing from the hotel spigots indicated that the overworked chemicals had been unable to produce a finished product. Technical supervision might not have been able to produce a better effluent, but at least it could have insisted on choking the effluent valves enough to get as much as possible out of the filters.

That laymen city officials are not wholly to blame for the conditions outlined is indicated by a paragraph in a recent report by a consulting engineer, on waterworks extensions in a Western city. It stated that a mechanic of ordinary schooling could operate successfully a proposed filter plant after 30 days' instruction by the filter company's operator.

Parsimonius city fathers often force non-technical operation upon plants designed by engineers. This is bad enough, but when a consulting engineer suggests it, the case is much worse. From one end of the country to the other appeal after appeal has been made to the general public to employ technically trained men to do technical work. No one calls in a tailor to remove an appendix, although he knows how to cut and sew. What protection has the unsuspecting consumer against typhoid fever when an intricate piece of mechanism like a filter plant must depend for successful operation upon a mechanic with ordinary schooling?

The feeding of chemicals to meet the ever-changing turbidity and pollution is no small problem even to one trained in chemistry, bacteriology and sanitary engineering. With expert direction the mechanic can manually operate a filter plant successfully, but observation of plants all over the country shows that the undirected mechanic is not getting efficient results out of his plant. Even when he produces a clear effluent he is depending too much on chlorination to make the indifferently filtered product bacterially safe. Engineers should not belittle the every-day operation of plants, on the successful supervision and control of which depend lives doubly valuable at this time. INTER. NOS.

"Best Buy" in Pavements

Sir—The article in *Engineering News-Record* of Sept. 27, p. 592, seems to condemn the selection of pavements by popular vote. It is probable that if the selection of the kind of pavement had been left to an engineer, the decision would have been unanimously in favor of some particular kind of pavement. If it had been left to a board of, say 12 engineers, there would probably have been as marked a divergence in the vote as there was in the popular vote. The board of engineers would doubtless have been less swayed by oratorical effort and would have voted more in accordance with the merits of the several offerings. The people were paying for the pavement, however, and if it is not satisfactory they have themselves to blame.

If the speeches of the several agents had been followed by a few words of advice from a competent engineer, or if such an engineer or public official had the veto power to prevent the selection of a positively poor pavement, I see no reason why the town meeting method of selection is not as good as the method of selection by council, which is the usual method. In fact, the town meeting idea for a small community is not to be sneered at. I do not think it would be advisable in a large community where indifference to public affairs is a besetting sin. If the judgment of an engineer were infallible—that is, if the decisions of several engineers were the same, or approximately the same—the sneer at the town meeting would be more justifiable. It is a fact, though, that the engineer is human. I have met a good many engineers and some of them were almost supermen, but I have met none that were quite beyond human limitations. Some that I have come in contact with, were, in spite of technical training, experience and knowledge, about on a par with the average mechanic or farmer, so far as business sense was concerned.

Much more serious affairs than the selection of a pavement are often left to the popular vote. The bond issue for the whole improvement is usually decided thus, so why not the minor matter of the use of brick or asphalt pavement, or stone or concrete curb? The main objections are that the method is cumbersome and that probably in time indifference on the part of a large

majority might occur; also that the town meeting might be influenced by bombastic and extravagant claims of promoters. But if the engineer is "on his job" and is a man of parts, he can usually pull the meeting his way if he knows his subject thoroughly and is willing to crawl out of his shell and tell what are his views.

In my opinion, a sound proposition would have a better chance before a town meeting than before a council the majority of which had been "seen" by one of the promoters of a rival proposition.

I trust that the day will never come when the people will become so indifferent to matters of public welfare that they will delegate all authority to experts. When that day comes we shall need also a "Kaiser" to control the experts.

The community or town-meeting plan of government is, I am informed, still in vogue in several large places in New England. It would be interesting to hear from some of the technical advisers to these large towns as to how far they are controlled by the popular vote in directing public affairs.

N. F. HOPKINS,
Of Harrop, Hopkins & Taylor, Civil and Mining Engineers.
Pittsburgh.

The Spacing of Stitch Rivets

Sir—In *Engineering News-Record* of May 10 you printed a few paragraphs from me on the spacing of stitch rivets in which I considered the maximum spacing allowed by the slenderness ratio only. E. J. Squire and P. J. Markmann in your issues of June 21 and Aug. 2, respectively, introduce the strength of the rivet as a controlling factor. As a matter of fact both of these tests should be applied.

In the case of the strut made up of two 6 x 3½ x ½-in. angles spaced ½ in., if it is desired to use a ¾-in. rivet Mr. Markmann's solution, giving a spacing of 19.2 in., seems to be satisfactory. And since this is less than 32 in., the maximum allowable uniform spacing as determined by the slenderness ratio, it may be adopted. Two ¾-in. rivets at each of the one-third points would more than take care of the shear for the 32-in. spacing. Since this would require four rivets, however, there is no question but that these four rivets would give better service if equally spaced singly at one-fifth of 96 in. or 19.2 in. than if spaced in groups of two each at the one-third points.

Mr. Markmann has too many rivets at the ends. As he says, the rivets there must take care of both the thrust and the moment.

For $L/r = 66.2$, total thrust may be $11{,}370 \times 2 \times 4.5$ or 102,330 lb. This calls for 10 rivets.

The moment, $\frac{1}{12}WL^2$ is 23,300 in.-lb. and the corresponding stress in the extreme fiber is 4630 lb. per sq.in.

The shear is $\frac{\frac{70L}{r}}{c} \cdot Q$ or 6000 lb. (using Mr. Squire's notation), which calls for 1 rivet.

But this does not take care of the bending moment. The center of pressure in the angles is not at the surface of the gusset plate but is $\frac{1}{2}\left(\frac{23{,}300}{6000}\right)$ or 1.94 in. from the central plane of the gusset plate; and there results a tendency to pull the angles away from the surface of the gusset plate. This causes a tension in the rivets. Supposing the extreme rivets of the connection to the gusset plate to be 12 in. apart (which is probably too small), and that the end rivets alone hold the angles against the gusset plate, we have a tension in the end rivet of (not over) $\frac{1}{2}\left(\frac{23{,}300}{12}\right)$ or 970 lb. Twelve rivets, probably 11, would be ample.

Using Mr. Markmann's figures, total shear due to moment is 46,800 lb. and one-half the thrust is 49,950 lb. One angle should be capable of carrying both of these or 96,750 lb. This would mean an average of over 20,000 lb. per sq.in. on the entire sectional area of the angle.

The original paragraphs were written to call attention to the danger of neglecting the slenderness ratio of some of the component parts of a column, and to make a definite numerical illustration. The introduction of the rivet strength as suggested by Mr. Squire and Mr. Markmann is an equally important though distinct consideration, and thanks are due to both men for their criticisms and additions to the original idea.

Lewis Institute, Chicago. ALEX. W. MOSELEY.

Macadam Roads Not Best for War Traffic, Says Engineer

Sir—It is generally recognized that the macadam road is not the type of construction that is adapted to modern highway traffic. In those localities where a considerable investment had been made in macadam roads, experience has shown that it has been impossible to maintain these roads in suitable condition for today's traffic except at a nearly prohibitive cost for maintenance, many times that which was necessary one or two decades ago.

Highway engineers have for many years striven to impress upon the public the ultimate economy of more substantial construction and their work today is bearing fruit. It seems, therefore, to the writer, unfortunate that there should appear in such an influential paper as *Engineering News-Record* anything which would seem to destroy the public's confidence in the extensive road expenditures which are being made and contemplated for substantial road improvement in so many sections of the country.

I have reference to the headline in your editorial in your issue for Sept. 13, reading "Macadam Roads Best for War Traffic." This editorial reviews briefly the splendid article by William J. Weir, in the same issue.

Mr. Weir is careful to state in his article that he had but limited time for observation, and also that his observation was confined to macadam roads, as these were the only ones that had been built by the French Government in the war zone and in areas tributary thereto. His article also gives a very clear intimation that these roads were kept in condition for war traffic only by the most strenuous efforts. Just how many men per mile it was necessary to keep along the roads to make the constantly necessary repairs is not stated but it is well known that it was very large indeed—at times a matter of thousands. A logical conclusion to be drawn from his description of the work that was necessary to keep the macadam roads in passable condition is that

the macadam road system did not break down because of most extraordinary and highly organized effort to keep traffic going.

That far from indicating that macadam roads are best adapted for war time traffic, the facts to be gained demonstrate that war time traffic made an even greater maintenance necessary than the demands of peace time traffic. That where there has been shown to be true economy in more durable types of road construction than macadam for peace-time motor traffic, there is even greater need for war-time motor traffic to have the most durable type of construction available if man power is to be conserved and the roads to be kept passable without the frightful cost that has been necessary to keep the macadam roads in France in condition for the severe test to which they are now subjected.

A. N. JOHNSON,
Consulting Highway Engineer,
Chicago. Portland Cement Association.

[The editorial note to which Mr. Johnson refers was based mainly on the following statements in Mr. Weir's article:

"One is inclined to wonder just what would happen to our bituminous highway surfaces, to our 6-in. concrete, or to our brick construction if these were subjected to the continuous pounding of traffic such as occurs, for instance, on the Amiens road. They would develop severe weakness, of course; no standard surface would withstand such wear. I believe that the difficulties in repairing them in kind would be enormous, owing to absolute lack of time for necessary refinements."

Further on, under "conclusions," Mr. Weir says: "The general type, water-bound macadam, has proved itself well suited to special maintenance requirements of war conditions. Surfaces requiring prior mixing, careful laying, special equipment, or time for setting would have been a source of great difficulty."—Editor.]

Should Engineer or Council Decide What Material to Use?

Sir—Should the engineering department of a city or the city council decide what materials are to be used for sewers, pavements, water mains, etc., in the various branches of the municipal service? My own opinion is that the function of a city council is to determine matters of policy, in a legislative sense, and it does not seem to me that this function should be sufficiently inclusive to cover such technical matters as fall properly to the city engineer in his administrative capacity.

A city council does not pretend to determine the size or slope of a sewer; no more should it decide the material of which the sewer should be constructed. In the matter of sewerage, it seems to me that the function of a city council is to determine that a certain area or street should be improved by the construction of sewers. Similarly, the function of the council should cease when it is decided which new street should be constructed.

When this matter is carried further to the question of resurfacing of streets, there is more room for argument. The city engineer or department of public works of a city must present an annual budget, and in order to support this budget intelligently should show a carefully prepared program of proposed work. In passing on this budget the city council naturally has the right to question the necessity of certain items and in the matter of resurfacing of streets it would be extremely difficult to prevent "log rolling" among the councilmen. However, I believe that in this particular matter the council's power should be limited to making a cut in the amount appropriated for resurfacing streets and the decision as to which improvements shall be eliminated to meet this cut should be left to the city engineer.

The whole question undoubtedly comes back to deciding just what is a representative government. There is no doubt that in our desire for efficiency our natural inclination is toward curtailing the power of the council.

H. S. MORSE,
Bureau of Governmental Research.
Detroit.

Road-Shoulder Maintenance in New York

Sir—My attention has been called to an article in *Engineering News-Record* of Sept. 20, p. 530, entitled "Road Shoulders Must Be Kept Clean." I note that you state you have made quite a continuous trip through several states, and in only one locality were highway officials making a practice of scraping the shoulders of improved roads. I beg to call your attention to the fact that the New York State Highway Commission for several years has made a practice throughout the state of reshaping shoulders, usually with road scrapers. This year, in this division, we have scraped shoulders amounting to 20 miles of road in Tioga County, about the same amount in Chemung County and probably half that amount in Schuyler and Allegany Counties. The amount in Tompkins County will probably be slightly greater and the amount in Steuben County will approximate 15 miles. Two other divisions that I am familiar with in this end of the state also make a practice of keeping the shoulders in shape.

Owing to the great increase in motor traffic since the first highways were built the 14-ft. roads on main lines are too narrow to accommodate this increase. Consequently, the fast traveling motor vehicles run with the right wheels on the shoulder of the road, which is noticeable where the older roads have become roughened with constant use and patching. This forms a small gutter alongside the macadam and keeps the water from reaching the ditches, a condition that we are trying all the time to change by continuous shoulder work. This year, it was very noticeable, owing to the extensive rains in this section, that grass and weeds made their appearance within two months after the old sod had been scraped away. Grass growing on the shoulders catches more or less of the fine material which is worn and washed from the macadam roads, causing in a great many instances a slight raising of the shoulders, which has the same effect as that noted above. At the beginning of the present year this division purchased three large road scrapers for this shoulder work, to be added to smaller scrapers purchased in former years.

I hope that this will give you an idea that this shoulder work is general throughout New York State.

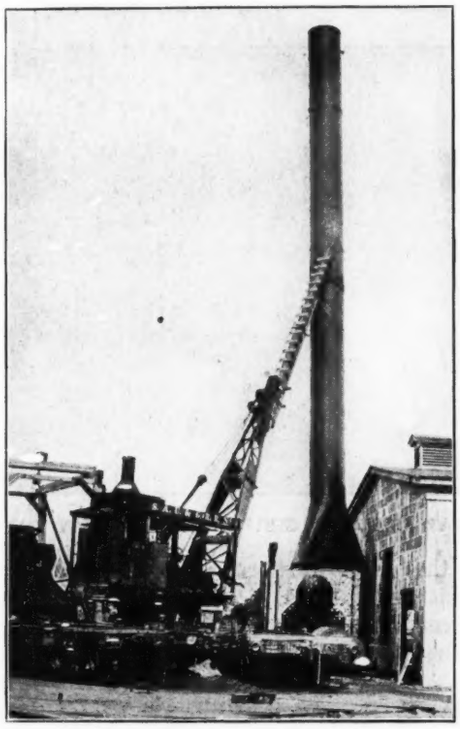
CHARLES M. EDWARDS,
Division Engineer, New York State
Hornell, N. Y. Highway Commission.

THE ENGINEER IN FIELD AND OFFICE

A DEPARTMENT DEVOTED TO DETAILS OF THE DAY'S WORK

Steel Stack Is Erected by Ditcher

PLACING a new steel smokestack by the use of a railway ditching machine as a crane was accomplished recently at the shops of the San Antonio, Uvalde & Gulf Ry., at North Pleasanton, Texas. The photo-



RAILWAY DITCHING MACHINE USED AS A CRANE TO ERECT A STEEL SMOKESTACK

graph and accompanying notes have been furnished by E. R. Breaker, chief engineer.

The stack was 4 ft. in diameter and 70 ft. high, and was placed on top of a brick setting 12 ft. high. It was riveted up alongside the boiler house where it was to be erected. The railway company's "American" ditcher, mounted on a car, was brought to the site, and with dipper and dipper handle removed formed a revolving crane. The length of the steel boom was increased 18 ft. by means of an 8 x 8-in. timber bolted to the end. The head of the timber was mortised for a sheave, over which was led a single cable direct from the drum.

A chain was wrapped around the steel stack just above its center of gravity. With the boom of the ditcher lowered, the end of the hoisting cable was hooked to the chain. The boom was then raised so that the stack would clear the building while being hoisted, and the hoisting cable then lifted the stack till it was about 1 ft. above its final position.

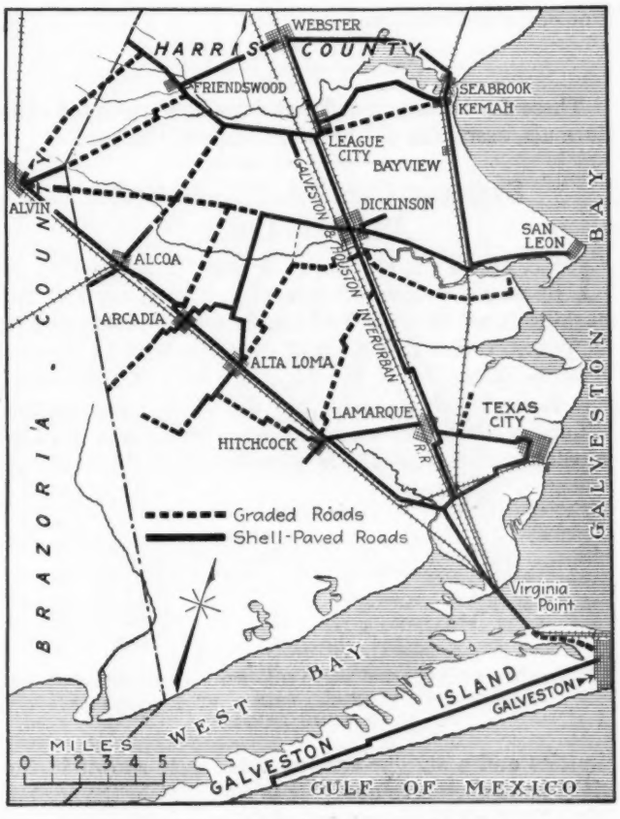
The ditcher was then swung around and the boom lowered to bring the stack into proper position. This stage of the work is shown in the view. The hoisting line was then slacked off sufficiently to lower the stack upon the seat prepared for it. The stack was held in position by keeping a tension on the line until the guy wires were adjusted and secured.

The work was done in about four hours by four men, including the man in charge and the engineman on the ditcher. It was under the supervision of A. S. Case, superintendent of bridges and buildings.

Maintaining an Extensive County System of Shell Roads

IT HAS been found by R. M. Sias, county engineer of Galveston County, Texas, that the amount of traffic on shell roads can be measured by the amount of new shells added per year. In his report for the year ended July 1 he indicates that it required an average of 352 cu.yd. per mile for the 56.7 miles of main road, and only 47 cu.yd. per mile for the 74.4 miles of lateral road. The greatest amount required was on the road from the city limits to the causeway, where 1006 yd. per mile were required to keep the road in shape—this section getting practically all the traffic coming into the city.

The roads are originally constructed to a thickness of 8 inches. In dry weather and under heavy traffic the shell pulverizes and forms regularly recurrent cor-



SHELL ROADS LAID OUT IN LOOPS

rugations from 20 to 24 in. on centers. Sometimes these corrugations extend across the pavement. Satisfactory repairs can be made only in wet weather, and simply amount to cutting down these corrugations, reshaping with a grader, and adding the necessary quantity of shells.

On account of the excessive wear exhibited by this type of pavement, Mr. Sias expects to repair the causeway branch and the road to Houston with two or three inches of broken stone or gravel, to take the abrasive wear. Some form of bituminous binder and mat will be used with this wearing surface.

Formulas for Excess Volume in Flared Concrete Column Heads

IN COMPUTING the volume of the capital or flare in a column for girderless concrete floor construction, a simple method is to determine the volume of the flare outside of the column shaft, which is itself figured as running from the top of one floor slab to the bottom of the next slab above. Formulas for this additional volume have been deduced by Edgar H. Mosher, of Washington.

Where V = volume of concrete to be added to the volume of a straight column figured to the bottom of the slab; D, diameter of flare or top of capital, and d, diameter of column, the formulas are as follows:

For square columns,

$$V = \frac{(D - d)^2(D + 2d)}{6}$$

For round columns,

$$V = \frac{(D - d)^2(D + 2d)}{7.63}$$

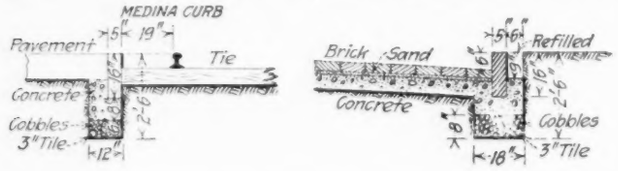
For octagonal columns,

$$V = \frac{(D - d)^2(D + 2d)}{7.23}$$

These formulas are deduced from the truncated cone formula, assuming 45° to be the slope of the flare.

Syracuse Uses Tile Drains Under All Street Curbs

THE accompanying sketches show how the City of Syracuse drains all pavement foundations. The curbing is set in a block of concrete 18 in. wide and 12 in. deep. Under this block of concrete is 18 in. of cobblestone filling, along the edge of which is laid a 3-in. tile drain which empties into the sewer catch-basins. Wherever there are street railway tracks a 5 x 16-in. Medina curb or header is placed against the ends of

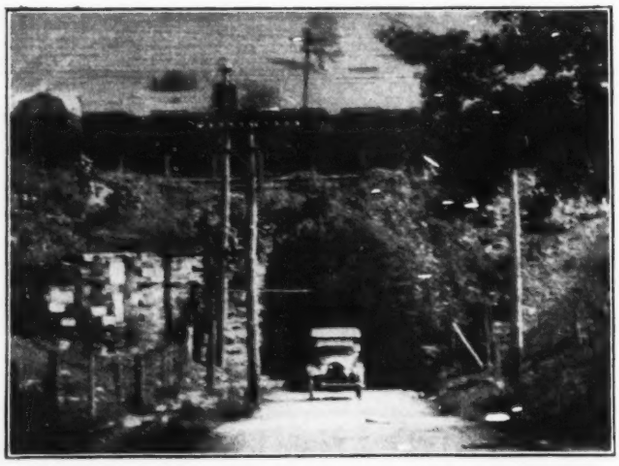


STANDARD DRAINAGE DETAILS FOR CONCRETE CURB (LEFT) AND SPECIAL CURB AT RAILROAD CROSSINGS (RIGHT)

the ties and a similar construction, as is shown in the right-hand sketch, is used. It is said that in the spring, when the frost is coming out of the ground, these drains empty a continuous flow into the sewer catch-basins, and there is no question but that they save many pavement troubles. They are used in all kinds of subsoil and beyond the price of the tile they add practically nothing to the cost of the pavement.

Culverts for Highway Underpasses

THE GENEROSITY of early railway engineers in the designs of culverts has made it possible to use some of them as highway underpasses in parts of West Virginia. The accompanying view, taken on a road leading from Bluefield west, shows a waterway converted into a highway. It is intended to utilize culverts in McDowell County in the same way. Evidence



RAILWAY CULVERT SERVES AS HIGHWAY UNDERPASS

exists that some of these culverts have been altered to admit the passage of vehicles. Most of them are damp continuously and undoubtedly there are times when the roads which they span are impassable.

Earth-Road Maintenance Handled by Contract in Kentucky County

By C. S. Bennett
State Engineer and Inspector, Greenup, Ky.

AS SOON AS the well-graded, crowned and drained state-aid earth-road system was completed in Greenup County, Kentucky in 1915 and 1916, the question of proper and adequate maintenance arose. Earth roads, especially in hilly country, require a maximum of maintenance, and the continuous system is the only proper way to keep them in shape. The roads had all been relocated, being placed above the high water from the Ohio River and its small tributaries; were graded to a maximum of an 8% grade, with a general ruling grade of 5%; and were drained thoroughly by means of galvanized pipe and reinforced-concrete box culverts.

After considering various methods of maintainence, it was decided to adopt the contract method. The specifications as finally drawn up embody provisions for dragging, cleaning ditches and culverts, cutting weeds on the county's right-of-way, maintaining a crown, etc. Bids were then asked for and work on each section was let to the lowest responsible bidder. Mileage was considered the basis for payment, while slides and washouts were paid for by the cubic yard. The work was usually let in five-mile sections.

A road drag, two drag scrapers, one wheel scraper, shovels, and mattocks, were furnished to each contractor, being charged against him with the provision that at the expiration of his contract he account for all tools supplied to him. In addition, two large blade road graders were purchased by the county, being lent to the various contractors as they were needed in shaping up the roads in the spring season. A contractor was required to own at least one team.

The work was under the supervision of the county road engineer, who notified the contractors when they were to drag the roads and when to cut the weeds on the county's right-of-way. He also issued to them instructions as to other details of the work.

Payments were made quarterly, the payments being so distributed as to make a maximum payment fall at a time when the greatest amount of maintenance was necessary. Thus, for instance, a contract dated Jan. 1, 1916, stated that payments would be made to the contractors as follows: 20% Apr. 1; 40% July 1; 15% Sept. 1, and 25% Dec. 31. The maximum payment, 40%, was made at the end of the spring season, during which time the greatest amount of work is necessary to keep the roads in condition. In addition, each contractor was required to give bond for the faithful performance of the work called for in his contract. Strict adherence to the terms of the contract, especially in regard to dragging the roads, was insisted upon.

The cost of maintenance on seven sections of road for the year 1916 is as follows:

Contract No.	Length, Miles	Bid per Mile per Maintenance	Bid per Cubic Yard for Earth	Bid per Cubic Yard for Rock	Total Cost per Mile
45 D 1	4	$45.00	0.35	0.40	$48.50
45 C 1	5	56.00	0.37	0.37	61.05
45 G 1	5	40.00	0.24	0.35	40.35
45 G 2	5	60.00	0.30	0.30	76.22
45 E 1	3	53.00	0.35	0.40	53.00
45 A 1	5	100.00	0.20	0.50	138.00
45 G 3	3	75.00	0.35	0.60	75.00

From a comparison made with similar work done in other counties under various other methods, the writer is led to believe that the contract method, properly looked after, is the cheapest method of continuous maintenance for earth roads. The contractors, being local men, take a certain amount of pride in their work and seem to enter into friendly competition as to which one can have the best looking section of road.

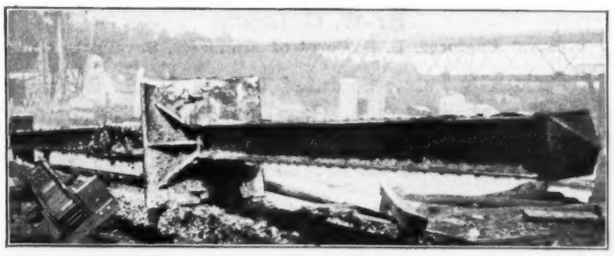
All of the maintenance work in this county is under the direction of R. M. Scott, county road engineer. The writer was resident engineer and inspector for the state on the construction of the system of intercounty roads then being built.

Report Stream Measurements in Missouri River Basin

A report that will be useful to engineers and others interested in the utilization of the streams of the Missouri River basin has just been issued by the United States Geological Survey, Department of the Interior, as Water-Supply Paper No. 386. The report represents the results of coöperative work between the Federal survey and the States of Colorado, Montana, Nebraska and South Dakota and includes descriptions of the stations at which the measurements were made and tables of daily and monthly discharge. Copies may be obtained without charge by applying to the Director, United States Geological Survey, Washington, D. C.

Iron Bearing Pile Survives a Quarter Century of Submergence

IN THE construction of the new Ozama River bridge in Santo Domingo described in the issue of Aug. 23, p. 353, excavation brought up some old iron bearing piles which had been placed in the former bridge in 1893. One of these piles is shown in the accompanying



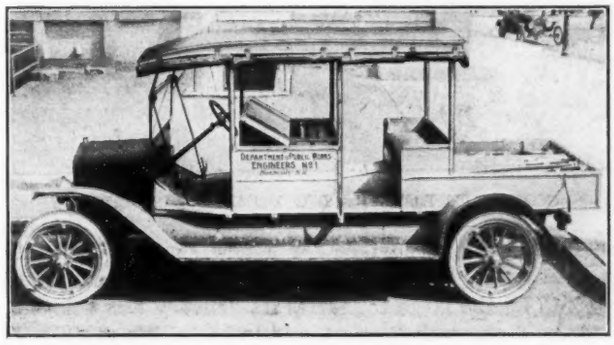
UNDER WATER FOR TWENTY-THREE YEARS—STILL IN GOOD CONDITION

picture. They consisted of a wrought-iron section with a cast-iron point, and a cast-iron bearing plate about one-third the way up from the bottom. This plate is 3½ ft. square and distributed a part of the load on the river bottom.

The bridge in question was built of iron of English manufacture. Although neglected for years in a tropical climate it was remarkably free from corrosion when removed. The pile itself was hardly damaged.

Manchester Public Works Field Parties Use Remodeled Ford

THE DEPARTMENT of Public Works of Manchester, N. H., has lengthened two Ford chassis and provided them with special bodies for the use of its field parties. Each car carries six men and their instruments, the third seat being formed by the cover



A FIELD PARTY OF SIX AND THEIR INSTRUMENTS CAN BE CARRIED BY THIS CAR

over the space occupied by the transit and level just back of the driver's seat. In the view shown this cover is partly removed, disclosing the two instrument cases. Tripods and other accessories are shown lying flat in the open box back of the rear seat. Each remodeled car cost $835, as follows: Chassis, $325; lengthening chassis, $100; special body, $200; extras and accessories, $210. Samuel J. Lord is director of public works of Manchester.

HINTS FOR THE CONTRACTOR

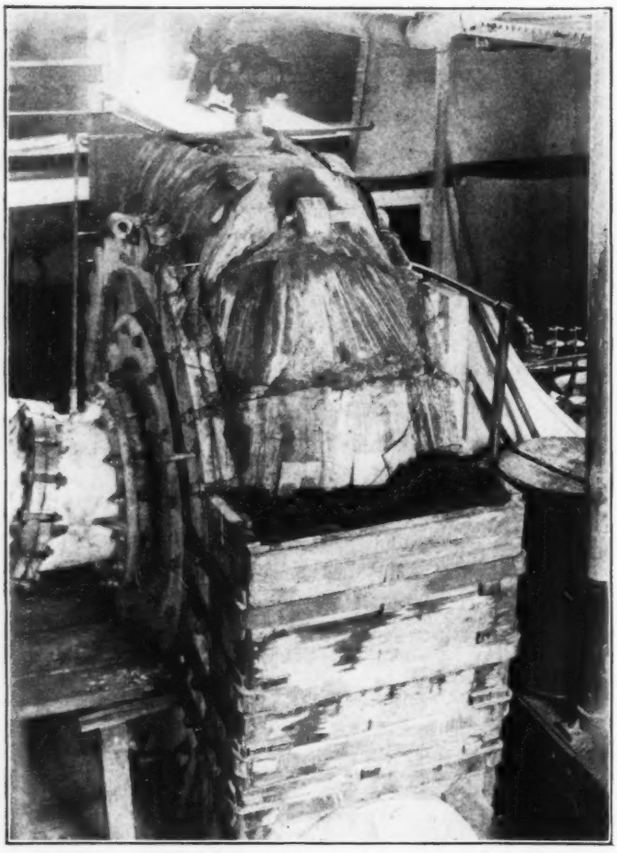
DETAILS WHICH SAVE TIME AND LABOR ON CONSTRUCTION WORK

Run 20-Inch Pump with Shattered Shell Incased in Concrete

By W. C. Lemen

Assistant Engineer, U. S. Corps of Engineers, Savannah, Ga.

A DREDGE being operated by the U. S. Engineer Office at Savannah, Ga., was saved last summer from shutting down on account of a badly shattered casing by the use of the broken pieces of the old shell as



CONCRETE REPAIRS BIG PUMP SUCCESSFULLY

an inner wearing surface for a new shell of concrete. A new casting had been ordered, but owing to rush of work in all the large foundries its delivery was delayed.

The old pump shell was found to be failing rapidly in a number of places, but at first those in charge tried by putting on cast-iron patches to make it last until the new one should come. This, however, proved inadequate, and it was found necessary to cover the upper part of the shell with reinforced concrete to a depth of 4 in. The concrete patch worked so well that preparations were made to incase the lower half of the shell as well. Before the concrete could be placed, however, the pump picked up a piece of railroad rail 4 ft. long, and drove it through the discharge side of the lower half of the shell, breaking out a section 1 ft. wide and 2 ft. long.

To patch this last hole more extensive concrete reinforcement was needed. The hole was first covered with pieces of cast iron, approximately the shape of the shell, and they were held in place with expanded metal. This reinforcement was about 4 in. from the form for the concrete. The form was bolted to the old casing with strap iron, as shown in the photograph, and the entire space inside it was filled with 1:3 cement mortar.

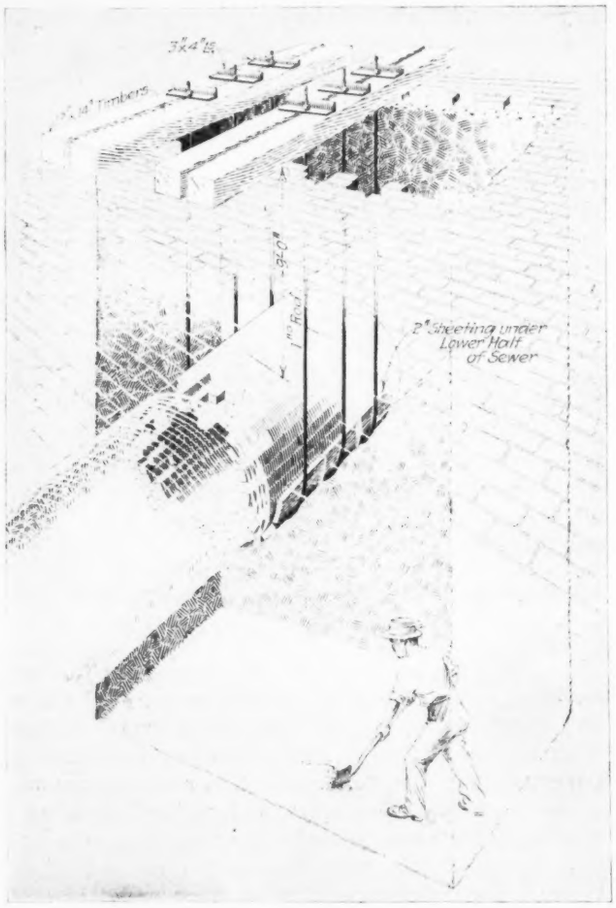
This work was done on July 15 last, and the pump has been in continuous operation since then with very satisfactory results.

Suspend 5-Foot Brick Sewer in Lagging by Hanger Bolts

By C. Louis Zull

Cincinnati

THE SUCCESSFUL suspension of a brick sewer of 5-ft. inside diameter was accomplished recently in Cincinnati. As indicated in the sketch, a large manhole which extended some distance below the sewer was built



SEWER SUSPENDED WHILE CONSTRUCTING DEEP MANHOLE

around it. The manhole is part of a conduit system being built by the Foundation Co. for the Union Gas and Electric Co. in connection with its power house, described in *Engineering News-Record* of Sept. 27, p. 593.

The manhole, located at the intersection of three streets, had to be of unusual depth in order to be located beneath all existing pipes, sewers and conduits. A brick sewer with an outside diameter of 7 ft. 2 in. ran directly through the manhole, its top being about 9 ft. below street level. Excavation was first carried down to about the center of the sewer, and the dirt under the sewer then removed in 3-ft. sections. As soon as a section was cleared, 2-in. sheeting in 3-ft. lengths was braced against the lower half of the sewer ring. As soon as a full semi-circular section of this lagging was in place the hanger bolts were set and drawn up. These bolts, by the way, were made by welding together a lot of old 1-in. round stock on hand to make 20-ft. lengths. The lower end of each rod was bent to a quarter circle, and the rods on opposite sides of the sewer fastened together under the center of the sewer by a compound lug, thus forming a big U-bolt out of each pair of rods.

At street level four 12 x 14-in. timbers were placed across the manhole excavation and the rods run up between them and bolted to pieces of 3-in. angles. As each set of rods was placed and the strain taken, the next 3-ft. section was excavated. In this manner 9½ ft. of the sewer was successfully caught up and held while the manhole was carried down 10 ft. below it.

Channel Bars on Stakes Furnish Rigid Support for Strike Boards

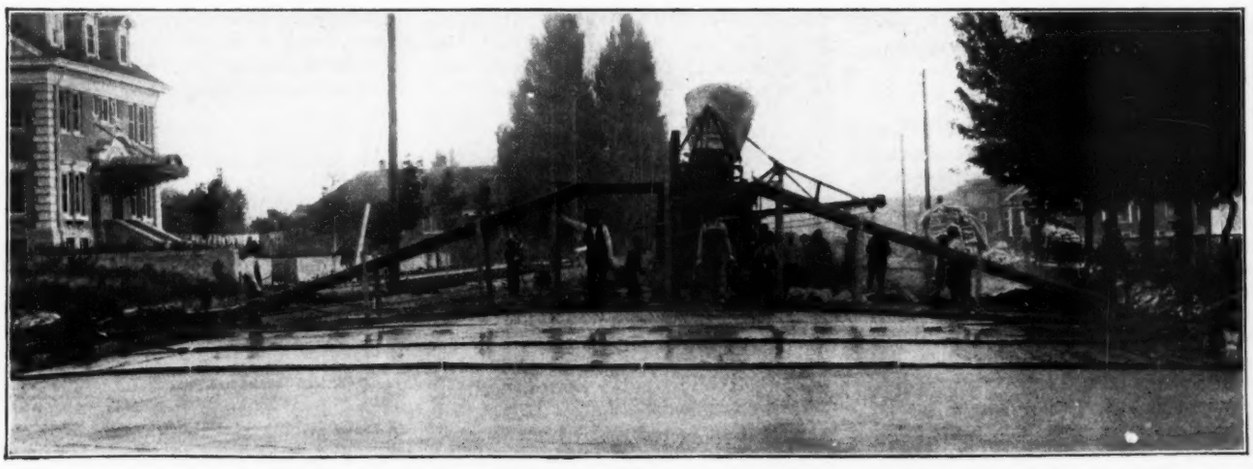
THE VERY wide streets and consequently wider intersections recently paved at Ogden, Utah, obliged the contractors to finish the concrete pavement from long trussed bridges and to carry the strike board on stakes capped with channels. Plank runways laid on U-bar chairs carry the wheeled bridge at intersections.

One of the photographs shows a 50-ft. street spanned by a trussed wooden bridge from which the concrete was struck off. Belts completed the work. At intersections the usefulness of such a long bridge is limited. Improvised bridges are often used over manhole tops if these happen to be available. If satisfactory bridges are not arranged for beforehand, workmen may attempt to use a board resting directly on the new concrete. A method found to work well for these long spans is to provide U-bar chairs of ¾-in. round iron or steel bars with pointed ends. Several can be driven across the intersection along the prolongation of the curb line and planks laid over the tops to make a runway for the finishing bridge.

U-BAR CHAIRS SUPPORT BRIDGE AT INTERSECTION

Rigid supports for straight edge are considered desirable when the street widths are 50 ft. or more. It is the practice in Ogden for the engineer to set parallel rows of stakes across the street, with the tops slightly below grade at intervals of 10 to 20 ft. The stakes in the rows are 3 to 4 ft. apart, and are capped with 4-in. channel iron laid flanges downward. On these channels the straight edge rides across the street.

All street work in Ogden is carried out under the supervision of Joseph M. Tracey, city engineer.



TRUSSED STRIKE-OFF BRIDGE SPANS FIFTY-FOOT STREET

NEWS OF THE WEEK

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

Southwestern Engineers To Hold Meeting at El Paso

The Southwestern Society of Engineers at its convention to be held at El Paso, Tex., Oct. 18-19, will be addressed by Dr. I. N. Hollis, president of the American Society of Mechanical Engineers and of the Worcester Polytechnic Institute. On the morning of the 19th a paper will be read by Dean G. M. Butler, of the University of Arizona. In spite of the fact that 20% of the members of the Southwestern Society are serving in the military forces of the United States, it has been felt best to hold the annual convention.

Standardized Ships Delayed by Boilers and Engines

The standardized steamship, of which there was much talk when the Shipping Board began its work and which has been carried to such a point of perfection in England that large ships are being launched within sixty days, has not contributed as yet to speeding up shipbuilding in the United States. A shipbuilder who has a Government contract and has given special attention to the problem, declares that the board will have more trouble getting the boilers and machinery built on time than it will the hulls.

Liberty Motor Truck Gets Trial

The two Liberty trucks that have been assembled have exceeded the expectations of not only General Chauncey B. Baker, of the Quartermaster Department, which has directed the work, but also of the engineers and draftsmen who worked on the design. Early tests of the engine showed 58 hp. at 1350 r.p.m., and the engine torque curve is better than anticipated. It is now assured that the U. S. heavy-duty war truck is one of the greatest engineering successes of the war, and that the truck will play a large part in affecting truck design in commercial circles.

Ohio Now Has Coal Dictator

As a result of the recent shortage of coal in the State of Ohio, H. A. Garfield, Federal Fuel Commissioner, appointed Homer H. Johnson, of Cleveland, coal dictator for the state. The situation had become very serious and mayors of cities throughout the state were preparing to seize coal from every source to prevent widespread suffering.

In several small communities light plants had been closed several days previous to Oct. 12 because of the lack of coal, many schools having been dismissed, and public utilities all over the state had to keep running on a very low supply of coal. On Oct. 12 the Columbus street car system was tied up for nearly an hour because of no coal in the bunkers, this being the second time within two days.

According to the latest reports, however, the condition of stress was being relieved.

Road-Building Regiment's Ranks Fill Rapidly

Men from All Parts of Country Seek Admission to 23rd Engineers as Result of News-Record's Campaign

As the result of the campaign which *Engineering News-Record* launched in its issue of Oct. 4, to secure volunteers with road-building and general construction experience for immediate service with the 23rd Engineers in France, applications are pouring in upon Col. E. N. Johnston, commanding officer of the new highway unit, which will be the largest regiment in the United States Army. On Oct. 15 this journal's representative was informed at Colonel Johnston's headquarters in Washington, D. C., that more than 1200 men had signified their willingness to serve with the road-building regiment now being organized. Scores of additional applications are being received in every mail, and to these is added a large volume of telephone and telegraphic inquiries as to enlistment.

In point of number of applicants and quality of men volunteering, the results have exceeded all expectations of Colonel Johnston and the members of his staff, who are outspoken in their praise of this journal's effective work in mobilizing the nation's road-builders for such use as the War Department may wish to make of them.

During the first few days after the issue of Oct. 4, carrying the recruiting message to the profession, had appeared, applications for enlistment came principally from men located in the Eastern States, a fact explainable by the distribution of *Engineering News-Record* from New York City. As time went on, however, and copies were put into circulation within a wider radius, the Middle West and South began to be heard from, while this week the mails contain scores of applications from the far Western States. One thing is clear: The 23rd Engineers will be, in no sense, a sectional organization, but will represent the best road-building talent of the entire country.

While the ranks are filling up rapidly there are still open in the new unit positions for men with the proper experience. Colonel Johnston wants to hear from men who have served as superintendents or foremen on road building or other construction jobs, steam-shovel men, roller runners, blacksmiths, quarrymen, powder men, road-grader operators, bridge carpenters, etc. On account of the huge size of the new organization, men of this type can still be assigned to positions of responsibility as noncommissioned officers. It should be repeated, however, that no man can offer himself for enlistment who has been called in the draft or been exempted. All applicants, too, must be physically fit, and must be ready for immediate service. A number of men have offered to join the 23rd Engineers provided their services were not needed for several months.

The commanding officer's desk at headquarters, 1419 F St., Washington, D. C., is piled high with application blanks, letters and telegrams regarding enlistment. These men are being carefully sifted with respect to age and experience, and to those who are considered to be qualified telegrams are sent directing them to report at the nearest recruiting station for enlistment. When sworn in, the military road-builders are directed to report at Camp Meade, Admiral, Md., where the military training of the highway regiment will be completed. From the information received in the applications it is often possible for the officers of the 23rd Engineers to make tentative offers of noncommissioned rank to the applicants. Many men have already been assigned to duty as corporals and sergeants.

Road-builders who wish to join the 23rd Engineers and who have not yet sent in their applications should do so immediately. Details regarding experience and method of making application were given in *Engineering News-Record* on Oct. 4, on pages 625 and 626. For the benefit of those who have not a copy of this issue available, applications should be mailed to the Commanding Officer, 23rd Engineers, National Army, 1419 F St., Washington, D. C., and the following form should be used in supplying information:

(1) Name
(2) Address
(3) Age
(4) Nationality
(5) Married or single
(6) Have you been called in the draft?
(7) Will you enlist for period of the war?
(8) State briefly your road-building or other construction experience
(9) What machinery can you operate?
(10) Your present or a former employer must certify to your qualifications by signing here and must give his address at which he can be reached by telegram.

Canada Feels U. S. Embargo on Iron and Steel

The iron and steel industry of Canada is being seriously embarrassed on account of the embargo imposed by the American Government on the export, except under license, of many iron and steel products which form the raw materials for manufactures in many cases extremely essential to the prosecution of the war. So threatening has the condition become that it seems likely that the at least temporary closing down of some plants will be a matter of the immediate future. A conference between leading iron and steel manufacturers and Sir George Foster, Canadian Minister of Trade and Commerce, was held at Ottawa on Sept. 28, which looks forward to a government supervision and conservation of iron and steel supplies.

In the meantime an attempt will be made to secure a statement of the immediate requirements, showing in detail the quantities and specific purposes for which the goods are needed by Canadian manufacturers. This statement will be forwarded to the United States Priority Board in the hope that the materials required will be released. Following is the composition of the committee which is preparing this statement:

P. L. Miller, of the Canadian Vickers, Ltd.; R. M. Davey, of the Dominion Bridge Co.; D. W. Fraser, of the Montreal Locomotive Co.; R. Harmer, of the Sawyer-Massey Co.; T. McC. Hutchison, of Drummond McCall & Co.; F. R. Humpage, of the Wilkes Twist Drill Co.; C. A. Waterous, of the Waterous Engine Company.

Oregon Will Have $3,000,000 for 1918 Road Work

The Oregon State Highway Commission will have available for next year's construction a fund approximating $3,000,000. Of this fund $2,000,000 will come from a bond issue, $220,000 from the quarter of a mill tax, $308,000 from auto-license fees and $472,000 from the Post Road appropriation, half of which is contributed by the Federal Government. If the assessed valuation of the state is taken as a basis of apportionment, 25%, or $750,000, will go to eastern Oregon and 75%, or $2,250,000, to western Oregon.

Springfield Turns from Garbage Burning to Hog Feeding

Owing to a reduction in the amount of garbage being collected and to the advisability of feeding garbage to hogs during the period of the war, construction was stopped on an incinerating plant being built for the City of Springfield, Ohio, under the direction of Charles E. Ashburner, city manager.

Ship-Building Companies Combine

To expedite the construction of shipping, the Bethlehem Steel Co. has formed a new corporation, known as the Bethlehem Shipbuilding Co., with headquarters at Bethlehem, Penn. E. G. Grace, president of the Bethlehem Steel Co., will be president of the shipbuilding company.

The shipbuilding plants affected by the consolidation are: The Fore River Shipbuilding Co., at Quincy, Mass.; the Harlan and Hollingsworth Corporation, Wilmington, Del.; Samuel L. Moore & Sons Corporation, Elizabeth, N. J.; Bethlehem Steel Corporation, Sparrows Point plant, Sparrows Point, Md., and the Union Iron Works, San Francisco.

Upper Court Rules Against Bone Retaining Wall Patent

The United States Circuit Court of Appeals for the Seventh Circuit on Oct. 2 affirmed the lower court decree of Jan. 26, 1916, in which a bill brought to enjoin infringement of the well-known Bone patent for reinforced-concrete retaining walls was dismissed. The case was Bone vs. Marion County, Indiana, and the claim was that a cantilever reinforced-concrete wall at Indianapolis infringed patent No. 705,732, issued July 29, 1902, to Frank A. Bone, of Cincinnati, Ohio. The upper court, Judges Alschuler, Evans and Landis sitting, affirmed the lower court in every particular. The decision, written by Judge Evans, holds that numerous publications, mostly in Europe, disclose prior invention of the reinforced-concrete retaining wall of the cantilever type and reaffirms the lower court opinion that had the judge in the Akron case, which was decided in favor of Bone, had before him the later evidence presented in the Marion case, he would have decided against the Bone patent.

The history of the Bone patent and a number of its predecessors was given in *Engineering News*, Feb. 3, 1916, p. 46. The lower court decision in the case of Bone vs. Marion County appeared in *Engineering News*, Feb. 10, 1916, p. 254; Feb. 17, 1916, p. 338, and in the *Engineering Record*, Feb. 12, 1916, p. 230.

Captain Nixon-Miller Commands American "Camoufleurs"

The company of American "camoufleurs," now in training at Camp American University, near Washington, D. C., is commanded by Captain Martin Nixon-Miller. Captain Nixon-Miller's company consists of artists, sculptors, architects and civil engineers. Captain Nixon-Miller was a member of the Pennsylvania National Guard for more than seven years. He served as assistant engineer under Major General Goethals, on the Panama Canal, and supervised the erection of an industrial plant at Pottstown, Penn., not long ago. After three attempts to obtain his services the Government finally secured them. Recently he has had charge of construction at the Frankford Arsenal. Captain Nixon-Miller and his men are working in conjunction with the Signal Corps of the army at Ft. Myer, Virginia.

New York City Accepts Catskill Aqueduct

At Dedication Ceremonies Last Week J. Waldo Smith and His Staff Receive Praise

The Catskill Aqueduct, on which construction for the first installment of 250,000,000 gal. per day has been completed for a number of months, was formally accepted on behalf of New York City by Mayor Mitchel on Oct. 13. Upon J. Waldo Smith, chief engineer of the Board of Water Supply, high praise was bestowed for his able conduct of work costing $177,000,000 and covering a 12-year construction period.

In accepting the great water-supply system Mayor Mitchel said:

"Great has been the contribution, the executive direction, the business judgment on the part of the members of the Board of Water Supply, and for that the people of the city will thank them through future generations. But, gentlemen, never has there been a bolder engineering conception or a more capable execution than that of Chief Engineer Waldo Smith in this great enterprise. It has been truly said that this work belongs to a class by itself. It equals in magnitude the construction of the Panama Canal; in the engineering difficulties of its conception and its execution, in my judgment, it exceeds the Panama Canal.

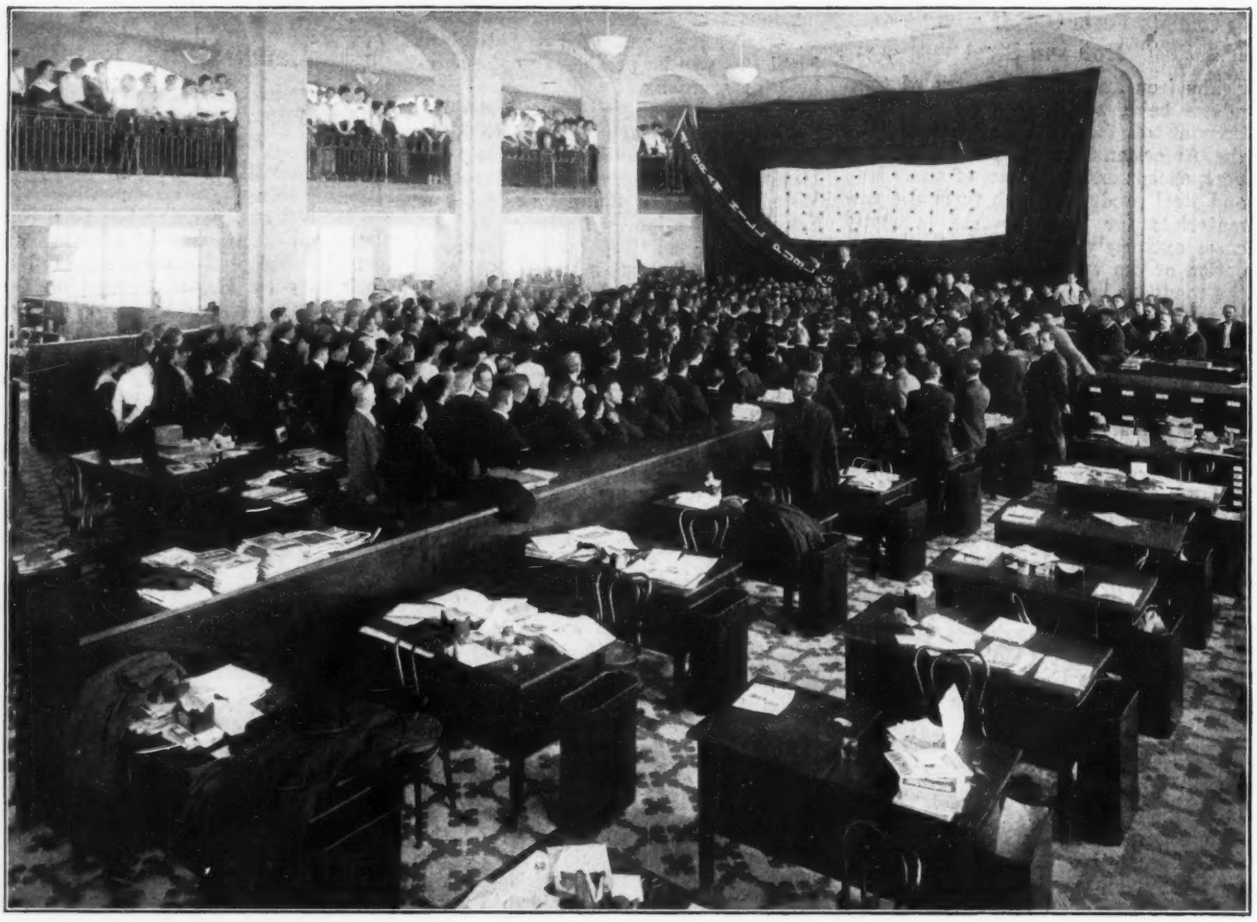
"One contribution that the Chief Engineer has made and which those who have not followed this undertaking closely might overlook, was the organization of the engineering staff. Nowhere, I believe, has there been gathered together a staff of engineers with more loyal spirit or devoted purpose.

"It is indeed a great achievement and a mark of distinction upon which these men who have carried out this great work and those who have dealt with them as contractors may congratulate themselves today."

At ceremonies in Central Park in the afternoon, Mayor Mitchel turned on the Catskill water, which leaped from the fountain to a height of 80 ft., while about 2000 persons cheered.

Men Nominated for American Society Offices

The Nomination Committee of the American Society of Civil Engineers have presented their report to the board of directors. The men named for the offices to be filled at the annual election, Jan. 16, 1918, are as follows: For president, Arthur N. Talbot, Urbana, Ill.; for vice presidents, John F. Coleman, New Orleans, La., and Nelson P. Lewis, New York City; for treasurer, George W. Tillson, Brooklyn, N. Y.; for directors, George W. Goethals, New York City; Andrew M. Hunt, New York City; Samuel Tobias Wagner, Philadelphia, Penn.; Edward E. Wall, St. Louis, Mo.; Milo S. Ketchum, Boulder, Colo., and Harry Hawgood, Los Angeles, California.



LIBERTY LOAN MEETING OF EMPLOYEES OF THE McGRAW-HILL PUBLISHING CO., INC., ON OCT. 9
A service flag with 42 stars was unfurled at the meeting, indicating that 42 members of the company had entered the military service of their country. Since that meeting four stars have been added to the flag

New York Building Zone Regulation Attacked in Court

The validity of the resolution establishing building zones in New York City, passed by the Board of Estimate in 1916, is attacked in a case now before the Court of Appeals (Estelle P. Anderson against Steinway & Sons). The concern just named refused to accept deed for property at 112 West 58th St., New York City, alleging that the passage of the zoning resolution subsequent to the signing of the contract to purchase placed an incumbrance on the property and made the Anderson title unmarketable because it places it in a residence district.

Steel Prices Satisfy Gary

E. H. Gary, chairman of the Steel Corporation, feels that, while the profits of some manufacturers would be reduced by the fixing of steel prices, conditions in the trade would be improved. Speaking as a member of the American Iron and Steel Institute Committee, which conferred with the War Industries Board over prices, he said:

"Our committee was in conference with the War Industries Board on Wednesday and Thursday of last week and agreed upon recommendations to the President concerning the prices to be fixed for many of the leading semi-finished and finished steel products, and these were adopted by the President as published. On the whole, it may be said, the negotiations with the War Industries Board and the results were satisfactory to the steel producers, although the prices named are lower than had been expected."

Construction Men Wanted for Service in France

Men who have had experience in any work connected with building construction, railroad construction or other engineering construction work are offered an opportunity to see immediate service in France with the Sixth United States Engineers, Colonel Harts commanding. This regiment will do general construction and engineering construction both behind and on the front line. The regiment has been fully organized for some time, but on account of increasing the personnel of the companies from 164 to 250 men it is desired to get the men best fitted for the work.

Construction men who wish to join this unit should send their applications, accompanied by statement of age, experience, etc., to the commanding officer, Sixth United States Engineers, Washington Barracks, District of Columbia.

Atterbury Nominated To Be Brigadier General

W. W. Atterbury, vice president of the Pennsylvania R.R. system, who is now supervising railroad operations for the troops in France, was nominated on Oct. 2 to be a brigadier general in the National Army. Mr. Atterbury was appointed director general of transportation of the United States Expeditionary Army in France on Sept. 14 after a month's service in active charge of all railways, docks and highways under General Pershing. Other nominations for promotion to the rank of brigadier general, which were sent to the Senate by President Wilson at the same time, were: Col. Isaac W. Littell, of the Quartermaster Corps, and Col. Frederick V. Abbott and Col. E. Eveleth Winslow, of the Engineer Corps.

Resume Lining Gunnison Tunnel

At the end of the present irrigation season, or about Nov. 1, work will be resumed on the placing of the concrete lining of the Gunnison Tunnel, Uncompahgre Valley Project, United States Reclamation Service, Montrose, Colo. This work will be continued throughout the winter and will give employment to about 150 men, including concrete subforemen, carpenters and motormen.

War Trade Board Appointed by the President

Proclamation Contains Regulations on Use of Enemy-Held Patents During the War

President Wilson has now established the administrative machinery to carry out the purposes of the Trading with the Enemy Act, approved Oct. 6. He has appointed a War Trade Board, with a war trade council to assist it. The machinery, established by proclamation, will take the place of the Exports Administrative Board, although Vance McCormick, chairman of the latter, will be chairman of the new War Trade Board. The members of the old exports board will also continue, and there will be additions to the new War Trade Board, as well as appointment of a number of officials, among them an Alien Property Custodian, not yet selected.

The regulations contain important items to administer the Trading With the Enemy Act, which contains various provisions as to the application for patents by citizens of the United States in enemy and ally of enemy countries during the war, and for the use in the United States by citizens of the United States of enemy-held patents during the war; and also for the suspension of certain information as to certain patent applications made in the United States, secrecy as to which is necessary for military reasons.

The Federal Trade Commission is empowered by the President to deal with all these patent matters, receiving applications and granting licenses with regard to them. The Commission is the power to which is granted the right to fix the prices of articles and products manufactured under licenses necessary to the health of the military and naval forces of the United States.

All correspondence in regard to exports should be addressed to the Bureau of Exports of the War Trade Board, the headquarters of which, for the present, will be at 1435 K St., Northwest.

In his proclamation creating the War Trade Board for the purpose of administering the Trading With the Enemy Act, the President also created a censorship and other boards which will have charge of carrying out some of the provisions of the Espionage Act. A representative of the War Trade Board will sit on the Censorship Board, as well as representatives of the Post-Office Department and the Committee on Public Information. This board will have full powers to censor cable, radio and mail communication passing between the United States and foreign countries. Control over communications with the enemy, forbidden by the Trading Act, are thus provided for in the proclamation, and the President has also established control over foreign exchange and transfers of gold, as well as censorship over foreign language newspapers printed in the United States, the transportation of enemies and clearances of vessels transporting cargo.

The proclamation is in part as follows:

"XVII. I further hereby vest in the Federal Trade Commission the power and authority to issue licenses under such terms and conditions as are not inconsistent with law or to withhold or refuse the same, to any citizen of the United States or any corporation organized within the United States to file and prosecute applications in the country of an enemy or ally of enemy for letters patent or for registration of trade-mark, print, label or copyright, and to pay the fees required by law and the customary agents' fees, the maximum amount of which in each case shall be subject to the control of such Commission; or to pay to any enemy or ally of enemy any tax, annuity or fee which may be required by the laws of such enemy or ally of enemy nation in relation to patents, trade-marks, prints, labels and copyrights.

"XVIII. I hereby vest in the Federal Trade Commission the power and authority to issue, pursuant to the provisions of Section 10 (c) of the Trading With the Enemy Act, upon such terms and conditions as are not inconsistent with law, or to withhold or refuse, a license to any citizen of the United States, or any corporation organized within the United States, to manufacture or cause to be manufactured a machine, manufacture, composition of matter, or design, or to carry on or cause to be carried on a process under any patent, or to use any trade-mark, print, label or copyrighted matter owned or controlled by an enemy or ally of enemy, at any time during the present war; and also to fix the prices of articles and products manufactured under such licenses necessary to the health of the military and the naval forces of the United States, or the successful prosecution of the war; and to prescribe the fee which may be charged for such license, not exceeding $100 and not exceeding 1 per centum of the fund deposited by the licensee.

"XIX. I hereby further vest in the said Federal Trade Commission the executive administration of the provisions of Section 10 (d) of the Trading with the Enemy Act, the power and authority to prescribe the form of, and time and manner of filing statements of the extent of the use and enjoyment of the license and of the prices received and the times at which the licensee shall make payments to the Alien Property Custodian.

Detroit To Allow Use of Concrete Segment Blocks in Sewers

Final confirmation of the decision of the Detroit City Council to allow the use of concrete segment blocks in sewers has been secured. As was intimated in these columns Aug. 30 and Sept. 6, the restriction now lies only against vitrified clay and shale segment blocks, all other types being permitted in the larger-sized sewers.

Dr. E. F. Roeber Dead

Eugene Franz Roeber, Ph.D., editor of *Metallurgical and Chemical Engineering*, one of the McGraw-Hill Publishing Co.'s papers, died Oct. 17. He was born Oct. 7, 1867, in Torgau, Germany, and received his education in the universities of Jena, Halle and Berlin. He came to the United States in 1894 to engage in electrical engineering work, later becoming editor of *Electrochemical Industry* and its successor, *Metallurgical and Chemical Engineering*. The latter paper developed with astonishing rapidity under Dr. Roeber's able direction. It was first issued as a monthly, but its growth in influence soon justified the change to a semi-monthly publication. Dr. Roeber was an indefatigable worker and to him is due the position of leadership in its field which *Metallurgical and Chemical Engineering* occupies.

Newark To Adopt Commission Form of Municipal Government

At a special referendum election held Oct. 9 in Newark, N. J., the supporters of the commission form of municipal government polled 19,000 votes against their opponents' 6000. The change in form of government will take place on Nov. 19, when the five commissioners, who will be elected at a special election Nov. 13, will take office. It has been estimated by the Newark Board of Trade that at least $100,000 a year will be saved by this change in the form of government. It has been estimated, also, that 160 city officials will be retired on account of the greater efficiency that will be gained.

Work Begun on Philadelphia Subway Loop

Preliminary work on the subway delivery loop which runs from Broad and Arch Sts. under Arch to Eighth St., under Eighth to Locust and under Locust to Broad St., in Philadelphia, has been begun with the starting of the excavation west of 10th St. on Arch St. and on Arch St. just east of 13th St. The work is being done by the Keystone State Construction Co. and the cost will total about $7,000,000. Under the present conditions of labor it seems likely that the work will take several years for completion. In prosecuting the work one square will be completed at a time to avoid interfering with the use of property along Locust Street.

Engineer Corps Wants Men for Non-Combative Service

A call has been issued by the Office of the Chief Engineer, War Department for topographers, topo-draftsmen and surveyors for work in other capacities than that of combatants. Men of the above professions who have been drafted, expect to be drafted or who desire to volunteer their services are requested to communicate with the Survey and Printing Battalion, War Department, Room 195, Washington.

PERSONAL NOTES

ROBERT B. KLINE has been appointed supervising engineer for the construction of the Emergency Fleet Corporation. Mr. Kline graduated in engineering from Harvard University in 1893, and after two years of construction work he became county surveyor of Montgomery County, Ohio, and superintended the construction of about 300 miles of interurban railways being built at that time. During 1904-5 he was in partnership with Charles Hoglen, building numerous bridges and steel structures in Dayton, which work he continued during his partnership with E. M. Gebhart, which is still effective. In 1906 Mr. Kline was appointed city engineer of Dayton. He is at present vice president of the Barkelew Metal Products Co., of Dayton, and maintains his office as consulting engineer in the Callahan Bank Building. During his service with the Government his business will be continued by his brother, Hubert M. Kline.

GEORGE B. ROTH has succeeded E. W. WENDELL in charge of the construction of the New York State road, which starts at the level of Brant Lake and runs to Graphite, at which place the mines of the American Graphite Co. are located. Mr. Wendell has been placed in charge of the state work in Clinton County and has his office at Plattsburg.

RAOULD RINFRET, who has been in private practice as consulting engineer for the past 30 years, has been appointed city engineer of Shawinigan Falls, Quebec.

BAYLY HIPKINS is at present connected with the engineering staff of the Foundation Co., and is now located on construction work on the Pacific Coast.

J. C. MCLEOD, of the office of the State Highway Commission of Oregon, has transferred his office from Roseburg to Curtin, in northern Douglas County, where work has been started on two new units.

RICHARD L. O'DONNEL, formerly general superintendent of the western Pennsylvania division, Pennsylvania R.R. system, became assistant general manager of the Pennsylvania Lines east of Pittsburgh and Erie on Aug. 20. During the Mexican border troubles last year, Mr. O'Donnel handled the entire transportation problem for the Eastern department, and he became adviser to the War Department in the question of troop handling when the present war was declared. Mr. O'Donnel was graduated from the Polytechnic College of Pennsylvania in 1882, and was employed for a short time thereafter as rodman in the construction of the Cornwall & Lebanon R.R. Entering the service of the Pennsylvania R.R. in 1883, as rodman, he became assistant engineer in the principal assistant engineer's office in 1886. Appointed assistant supervisor at Holidaysburg in 1887, he was in charge of a force of men at the time of the Johnstown flood in 1889. The same year he became supervisor in the Altoona yards, and two years later assistant engineer of the Tyrone division, being transferred to the Pittsburgh division as assistant engineer in 1894. Promoted to assistant superintendent of the Pittsburgh division in 1897, and later to superintendent of the same division, in 1903, he was appointed general superintendent of the Buffalo & Allegheny Valley division, and in 1911 general superintendent of the western Pennsylvania division.

H. M. PAFFORD has resigned as city engineer of Waycross, Georgia.

JOHN B. PAYNE, chief engineer and secretary of the Board of Commerce and Navigation, New Jersey, has tendered his resignation from that position and will retire from the state service after a tenure lasting 40 years. He was appointed to the position he is vacating some months ago, succeeding B. F. CRESSON, JR. Since his first connection with the New Jersey Riparian Commission in 1877, Mr. Payne has devoted himself principally to questions connected with this work. The resignation will take effect Oct. 1.

H. S. ROGERS, maintenance engineer of the Delaware & Hudson R.R. at Albany, N. Y., has been appointed division engineer in charge of maintenance-of-way on the Susquehanna division, with headquarters at Oneonta, N. Y. F. C. HOHN has been appointed division engineer on the Pennsylvania division, with headquarters at Carbondale, Penn., and G. D. HUGHEY has been appointed division engineer on the Champlain division, with headquarters at Plattsburg, New York.

A. J. RUSSELL and J. C. PARKER have opened offices as consulting civil engineers and architects in the National Realty Building, Tacoma, Washington.

C. R. MORRILL has been appointed assistant general manager of the Southern Pacific Railway, with headquarters at Houston, Texas. Mr. Morrill entered the railway service with the Southern Pacific in 1892, and was made roadmaster in 1897—being promoted four years later to division engineer. In July, 1904, he became assistant superintendent and in 1915 was appointed superintendent with headquarters at Houston, which position he has held until his appointment as assistant general manager.

PAUL C. GAUGER, structural engineer for the George J. Grant Construction Co., which has the contract for the new union depot at St. Paul, has been named the representative of the St. Paul Civil Engineers' Society on the committee which is to aid the commissioner of schools in making final plans for the new buildings to be erected under the bond issue recently passed in that city.

F. W. SCHREIBER, who for the past seven years has been city engineer of Watertown, S. D., has been appointed assistant highway engineer of the South Dakota Highway Commission.

FRANK S. PECK, who had charge of the planning and construction of the hard-surface highways in the Black Hills, has accepted the position of highway engineer with the above commission.

CAPTAIN WALTER R. METZ, Quartermaster Corps, U. S. A., who was formerly mechanical engineer and superintendent of buildings of the Government Printing Office, Washington, D. C., is at present stationed at Clintonville, Wis., on inspection work in connection with an order for approximately 4000 automobile trucks for the War Department.

HUGH L. WILEY, civil engineer and author, of Portland, Ore., has been commissioned first lieutenant in the 18th (Railway) Engineer Regiment, now in France.

F. W. GUERNSEY has been appointed city engineer of Dayton, Washington.

W. JACKSON, chief engineer of the Edmonton, Dunvegan & British Columbia Ry., has resigned.

R. B. BENNETS, of Tacoma, Wash., has been appointed chief engineer of the Ladysmith Smelting Corporation, Ladysmith, British Columbia.

L. O. MARDEN, formerly chief draftsman with the Oklahoma Department of Highways, has been appointed chief draftsman for the State Highway Commission of New Mexico.

N. CAUCHON, consulting engineer, Ottawa, has become associated with THOMAS H. MAWSON, the English town-planning expert, to collaborate in the replanning of Saloniki, for which purpose he has been commissioned by Premier Venizelos, of Greece.

ARTHUR F. SHUEY, formerly assistant engineer, Florida State Board of Health, has been appointed superintendent of the Tampa Water-Works Co., Tampa, Fla.

PROF. E. V. WALKER, head of the department of civil engineering of the Pennsylvania State College, has been commissioned captain, Fifth Regiment of Engineers, which has left Plattsburg for foreign service. PROF. HUGO DIEMER, head of the department of industrial engineering of the same school, has received a commission as major in the Ordnance Department, and is at present located at Lowell, Mass., inspecting firearms. Other members of the faculty who are in military service are: J. J. LIGHT, of the department of mechanical engineering, who has been commissioned captain; LIEUTENANTS STEEL, LONG and BRYANS, of the depart-

ment of civil engineering, are on duty at various camps. MR. MILLS, of the electrical engineering department, is in Washington on naval construction.

H. K. RUBEY, instructor in civil engineering at the University of Washington, has resigned to accept a similar position on the faculty of the Carnegie Institute of Technology at Pittsburgh. No successor to Mr. Rubey has been appointed as yet.

J. T. GEAR, recently city engineer of Kelso, Wash., has been appointed city engineer of Puyallup, Washington.

FRED H. CLARK, superintendent of streets, Springfield, Mass., has been reëlected for a five-year term.

DR. D. B. STEINMAN has been appointed associate professor of civil engineering in the College of the City of New York for the current year. He will retain his connection with the firm of Waddell & Sons, consulting engineers.

PROF. ALMON H. FULLER, dean of the department of engineering, University of Washington for the past 19 years, has resigned to accept a position as head of the department of civil engineering at Lafayette College, Pennsylvania. Professor Fuller has been with the University of Washington since 1898. So far no permanent appointment has been made to fill the position vacated by him in the University of Washington.

MAJ. ELLIOTT J. DENT, who has been in charge of the United States Engineer's Office, Seattle District, Portland, Ore., since the departure of LIEUT. COL. J. B. CAVANAUGH, has been promoted to the rank of colonel and has been assigned to the 26th Regiment of Engineers at present being mobilized in New Jersey. Colonel Dent will be succeded in the district by CAPT. ALBERT H. ARCHER, of the United States Engineer Corps, lately stationed at Vancouver, Washington.

HENRY M. SPERRY has been appointed publicity representative for the Union Switch and Signal Co., General Railway Signal Co., Federal Signal Co. and Hall Switch and Signal Co., with headquarters at 120 Broadway, New York. He was connected with the Union company and then with the General company for several years. Mr. Sperry began his career in 1881 in the engineer corps of the Pennsylvania R.R., and in 1887 became supervisor of signals on the New York Division. In 1905 he was consulting signal engineer for the Hudson Companies, New York City, in the preparation of plans for signaling in the Hudson River tunnels and the large terminal station at Church Street.

HAROLD D. HYNDS has resigned as engineer of the Atlas Portland Cement Co. and has accepted a position in the contract department of the Turner Construction Co., New York City. Mr. Hynds was in the technical service division of the Atlas company under E. D. BOYER. He is secretary of the American Concrete Institute, and the secretary's office therefore changes from 60 Broad St. to 244 Madison Ave., New York City.

H. I. DE BERARD, for 18 years chemist and bacteriologist for the Denver Union Water Co., has resigned his position and will continue his consulting work at Ontario, Calif. Following graduation from Beloit College in 1897 he took a postgraduate course in biology and bacteriology under PROF. E. O. JORDAN, Chicago University, when the application of these branches to water-supplies was in its infancy. Although Mr. De Berard's main energies have been spent in maintaining the integrity of Denver's intricate system of slow and rapid sand filters, lake, river and underground sources, he has also been engaged to handle the quality end of lawsuits at Raton, N. M., and Pueblo, Colo., and to help many of the other cities in the Rocky Mountain region with their algæ and sanitary problems.

B. K. COGHLAN has resigned as associate professor of highway engineering at the Agricultural and Mechanical College of Texas, having received a commission as captain in the Engineer Officers' Reserve Corps and detailed to Fort Leavenworth, Kansas. E. O. FRANCISCO, assistant professor of civil engineering at the Agricultural and Mechanical College during the last season, has received a commission as second lieutenant and has been detailed to the same post.

H. F. JOHNSON, formerly resident engineer on the construction of the Union Station Terminals at Kansas City, Mo., and later engineer in charge of the sewer division of the city engineer's office, Kansas City, Mo., has accepted a position as assistant engineer with the Union Pacific Railroad Co., and is now located at Hastings, Neb., having charge of terminal facilities now under construction at that point.

OBITUARY

WILLIAM WALTER MARR, chief state highway engineer of Illinois, died at Chicago on Oct. 3. He was born at Chicago in 1876. He graduated from Notre Dame University in 1895. Two years later he entered the engineering service of the City of Chicago, where he remained for several years, becoming a division engineer on the staff of the Board of Local Improvements. Later he was a member of the engineering firm of Marr, Green & Co. In 1915 he was appointed chief engineer of the State Highway Department and held this position (but with a different title) up to the time of his death. Mr. Marr will be best remembered as one of the first highway engineers to work out a rational system of choosing highway routes from the service standpoint. Early in his work for the state he deplored the haphazard manner in which laymen county commissioners rushing into road building chose routes and types of roads. Starting on the same basis as he would for a local improvement for proportioning a water or sewer system he evolved the method described briefly on page 536 in the *Engineering Record* of Apr. 22, 1916.

BRIG. GEN. HIRAM M. CHITTENDEN, U. S. A., retired, died in Seattle, Oct. 9, in his 59th year. He was graduated from West Point in 1884, commisioned second lieutenant in the Engineer Corps, and three years later admitted to the New York State bar. In 1886 he was promoted to first lieutenant, gained a captaincy in 1895, then successively became a major and lieutenant colonel. In 1910, while superintending the building of roads in Yellowstone Park, exposure brought about disability, including blindness. He was then appointed brigadier general and was retired on Feb. 10 of that year. During his career as executive officer of the Board of Engineers to investigate canal routes between Lake Erie and the Ohio River and as secretary of the Missouri River Commission, he conducted extensive investigations in arid regions. In 1897 the report was published and was one of the first American books to enter critically into the problem of controlling floods. From 1889 to 1906 he was in charge of the improvement of Missouri River and tributaries and of work in Yellowstone Park, and built or rebuilt the greater portion of the park's road system. He was the inventor of the type of movable dam known as the Chittenden drum weir. He served as consulting engineer for the Spring Valley Water Co., San Francisco, in 1912, and on the Dayton, Ohio, flood problem in 1914. He was the author of a number of books and a contributor to geenral as well as technical magazines.

THOMAS H. HUMPHREYS, advisory engineer in the Quartermaster's Department of the War Department, died Aug. 21 at his home in Washington. Mr. Humphreys was born in Oldham, England, and after his parents moved to this country he became an irrigation and drainage engineer in California. Entering the War Department in 1889, during the following 15 years he was engaged in various engineering projects in Western states. For the last 13 years he had been stationed in Washington and had had many assignments as supervising engineer in the construction branch of the United States Quartermaster Corps.

WILLIAM J. WOOD, member of the Indiana Public Utilities Commission and formerly attorney-examiner for the Interstate Commerce Commission, died in Indianapolis on Oct. 3. At one time Mr. Wood was third vice president of the Louisville & Nashville R.R., having charge of the legal department.

CHARLES W. KEMPTON, consulting mining engineer, died July 26 in Westboro, Mass. Mr. Kempton's

death was the result of illness brought on by exposure and fevers contracted on the Isthmus of Darien while engaged in making geological examinations for an interoceanic canal. Receiving his early education in engineering in the office of I. Herbert Shedd, of Boston, he accepted a position in the office of the engineer of locks and canals at Lawrence, Mass., where he remained about ten years, devoting all his spare time to the study of geology and mining engineering. In 1880 he went to New York City and opened an office as mining engineer. In 1910 his health had become so broken that he was forced to give up active practice.

THEO. STARRETT, founder of the Thompson-Starrett Co., building contractors, died Oct. 9 at his home in Prospect Plain, New York.

WILLIAM MURDOCH, city engineer of St. John, N. B., died Oct. 7.

ELMER ELLSWORTH COLBY, a consulting engineer of Chickasha, Okla., died Sept. 27. Entering railroad service in 1881 as rodman for the Chicago, Milwaukee & St. Paul Ry., he remained in this work until 1888, when he became county engineer for Greene County, Missouri, at the same time opening an office for the general practice of consulting engineering. During the following years he designed and superintended the erection of steel bridges over various rivers in the neighborhood of Springfield, Mo., and constructed concentrating mills and other mining work in the lead belt of Missouri. From 1900 to 1903 he was in charge of segregation and surveying for town sites in the Chicksaw Nation, Indian Territory, for the United States Department of the Interior. From 1906 to 1914 he was city engineer of Chickasha, Okla., and at the time of his death he was inspecting road work between that city and Fort Sill, Oklahoma.

BUSINESS NEWS

Advocates Government Credit To Aid the Railroads

It is not too early to begin to plan for the period of readjustment in the United States after the war, says the October *Bulletin* of the National City Bank of New York. Here, as in other parts of the world, there is no lack of work that ought to be done, and which, if done, will provide full employment, but there is danger of hesitation and loss of confidence in passing from war conditions to peace conditions. There is wanted for that time a big, definite program of construction work which will put a backbone into the situation.

The opportunity for such a program, is afforded by the railway situation, according to the *Bulletin*, which advances the following reasons for its belief: "It has been demonstrated that notwithstanding the great amount of capital expended upon the railways in the last 17 years, their development has not kept pace with the growth of traffic. Furthermore, it is apparent that the railway problem cannot be adequately dealt with by the companies acting independently and alone. The situation requires comprehensive treatment, particularly at terminals, looking far to the future, and requiring an amount of capital which the companies alone cannot undertake to raise in the state of the world's money markets in the near future, nor can expenditures planned upon a scale to care adequately for the future be expected to be immediately remunerative to the railroads, although the improved service would be advantageous to the country.

"An extensive scheme to develop and improve the country's transportation system would do more to equip the country for economical production and to enable it to hold its own in world's markets than perhaps any other single thing that can be done, and if such a program could be ready for announcement at the close of the war, it would put an end to all uncertainty and apprehension about business conditions in the United States in the period following the war.

"The Government's relation to the railroads up to this time has been wholly restrictive, but the time has come when it ought to be also constructive. Regulation is inevitably restrictive in some respects, and this phase of it tends to divert capital to other employment. To offset this effect the Government's relation to the railway business should be likewise constructive, giving some positive aid to the support and development of the great transportation industry, which it recognizes as holding a vital relationship to all the other industries.

"Such a program can only be promptly and adequately carried out, under the conditions which will exist at the close of the war, by the aid of Government credit, and it should be done under a just and reasonable arrangement between the companies and the Government, which will ultimately reimburse the Government, and at the same time provide an incentive for the initiative and enterprise of private management, and secure to the public the benefits of adequate and progressive service."

Conference of the Paving Brick Industry To Be Held

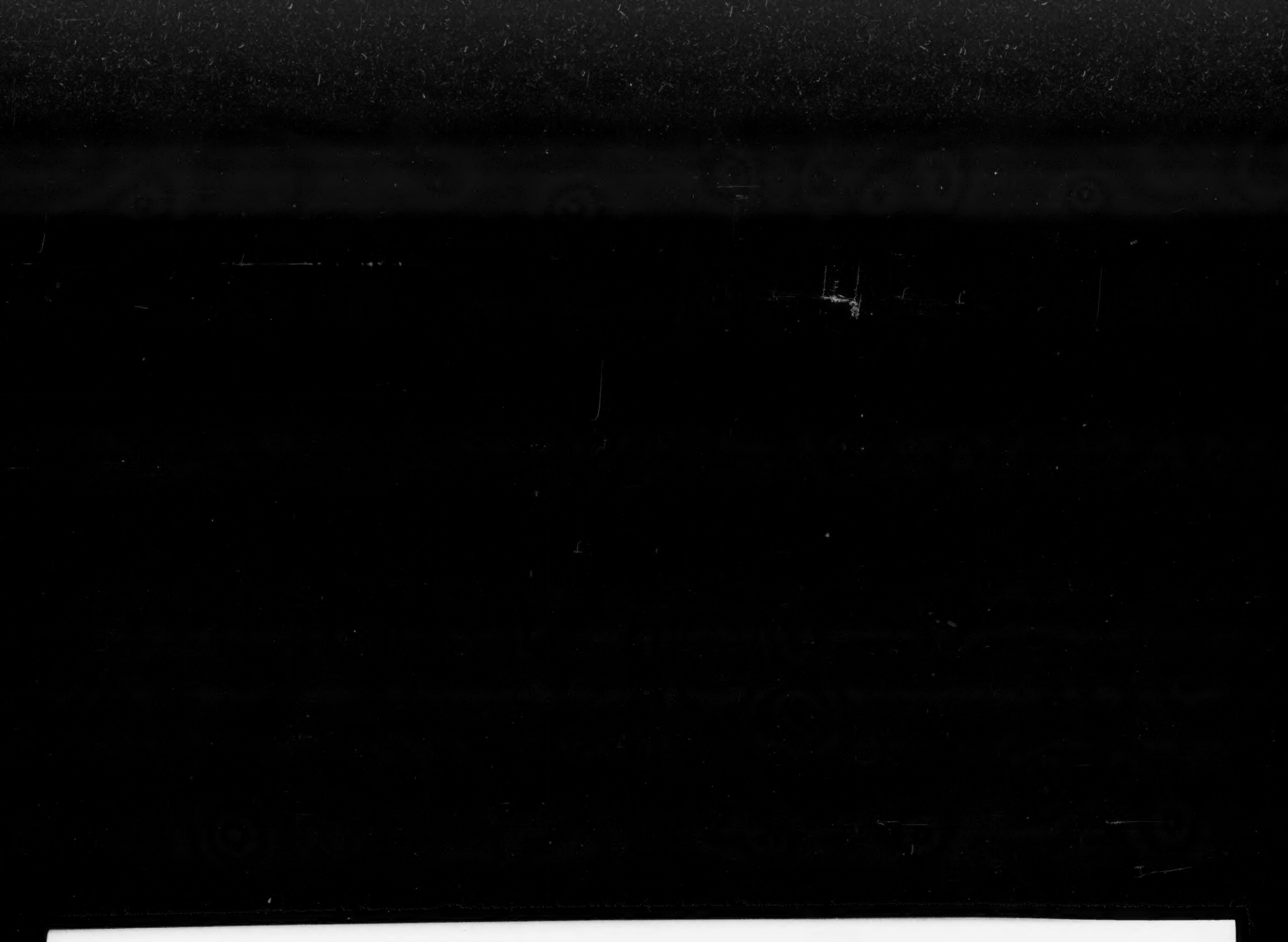
The annual meeting of the National Paving Brick Manufacturers Association will be held in Cleveland, Ohio, Nov. 19 and 20. As evidencing the spirit of the meeting, the office board of the association says: "A complex situation is created by the country's requirement for the greatest transportation facilities when that very need hinders the receipt of materials and fuel needed in the manufacture of brick, and delays paving work which should furnish transportation relief. Then, too, the Council of National Defense is recommending short-haul freight to be transported over the highways which either do not exist or are not in condition for this service."

The office board of the National Paving Brick Manufacturers Association is convinced that more good to the country and to the industry can be effected by a conference in which the entire industry is represented by its active executive officials, than by any other undertaking. All members of firms, board members of companies and other persons having financial interests in the business are invited and urged to attend the Cleveland meeting. Detailed information regarding it will be sent all manufacturers of paving brick as soon as prepared.

Notes from

MAKERS OF PLANT AND EQUIPMENT

Hydrated Lime Bureau, Pittsburgh, has appointed Tyrrell B. Shertzer, formerly city manager of Portsmouth, Va., to the newly created position of Eastern district engineer, with headquarters in New York City. C. W. Freitag, formerly construction superintendent for S. R. Smythe Co., construction engineers, Pittsburgh, has been appointed Western district engineer, with headquarters at the home office of the bureau in Pittsburgh. Appointments were effective Oct. 1.

Vulcan Steel Products Co. has opened an office in Havana, under the management of G. O. Simpson, to take care of its rapidly growing business in Cuba. In connection with this office, there will be maintained a permanent exhibition of machinery, and steel and iron products, in which the company deals. The company's branches or agencies are now maintained at Paris, France; Hongkong and Shanghai, China; Yokohama, Japan; Milan, Italy; Barcelona, Spain; Melbourne and Sydney, Australia; San Juan, Porto Rico; Singapore, Straits Settlements and Havana, Cuba. The company is also represented by well-known business houses in the following trade centers: London, Brazil, Portugal, Argentine, Uruguay, Paraguay, Peru, Chile, Bolivia, Venezuela.

Dodge & Dodge, dealing in contractors' supplies and equipment, and machinery for concrete work, have moved from 140 West 38th St., to 501 Fifth Ave., New York City, in order to have larger executive offices for handling their increased business. The firm still represents the Byers Machine Co. (auto cranes); Oshkosh Manufacturing Co. (mixers, saw rigs, pumps, back filling machines, etc.); Kent Machine Co., Kent, Ohio (continuous concrete mixers). Dodge & Dodge report that they are making headway with the Elgin motor street sweeper, manufactured by the Elgin Street Sweeper Co., Elgin, Ill.